SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

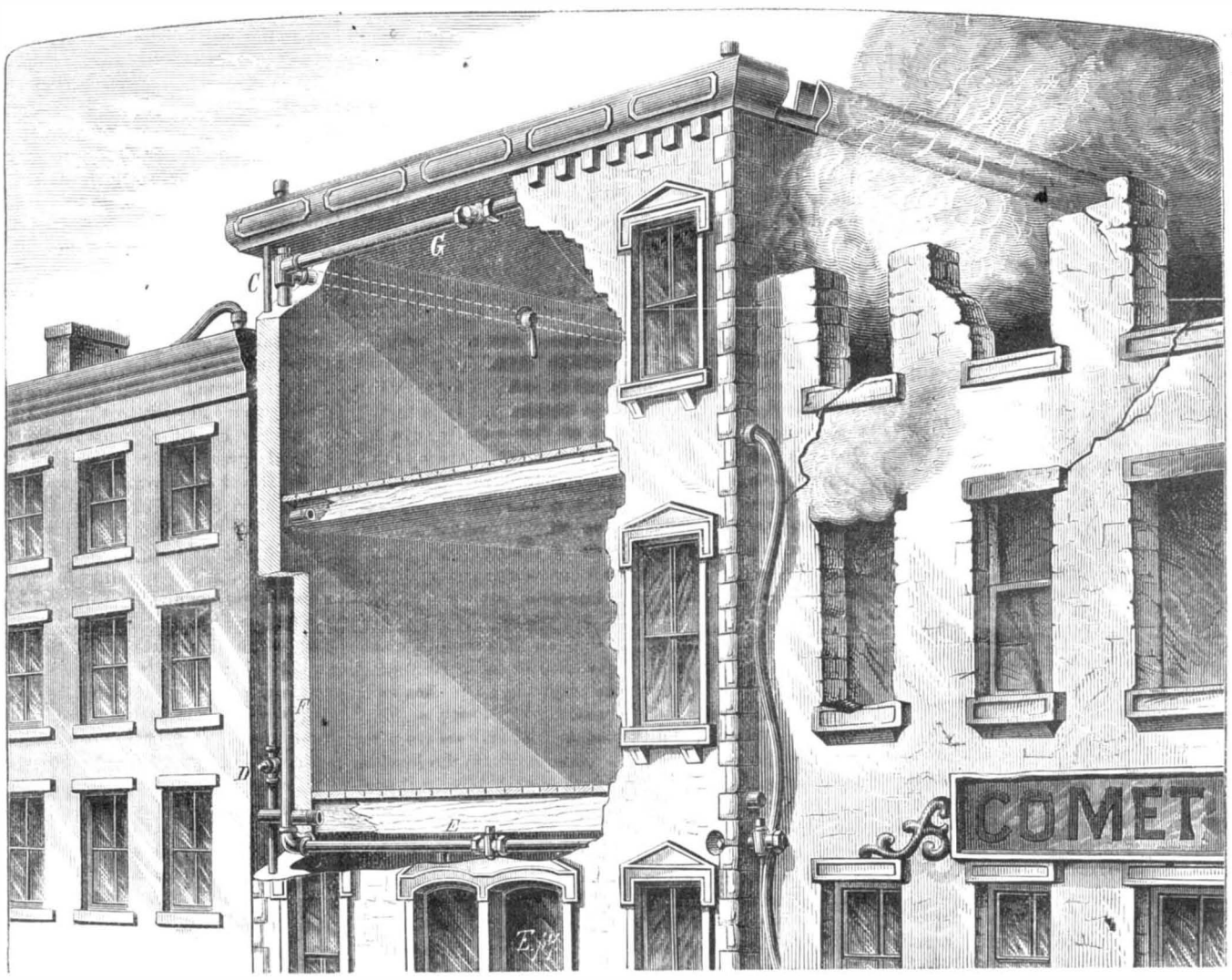
Vol. XXX.—No. 14. [NEW SERIES.] NEW YORK, APRIL 4, 1874. [$3 per Annum, IN ADVANCE.

FIRE EXTINGUISHING APPARATUS FOR BUILDINGS.

Illustrated in the annexed engravings will be found a novel and, it is believed to be, a most efficient device for protecting buildings of every description from fire. The invention consists essentially in a peculiar form of tank roof, which may be entirely submerged through its connection with a system of water pipes running through the edifice, as illustrated in our engraving. By means also below described, the outer walls may be kept constantly wet by a thin stream of water pouring down their faces. Perforated pipes are laid through the building, in order to afford a supply of water to the different stories; and finally, by suitable hose connections on the roof, streams of water may be thrown upon adjoining structures.

The roof arrangement is shown in Fig. 2, and consists of a flat sheet metal watertight covering, having around it a flange, A, within which is a partition, B, the two portions forming the eaves. The flange, A, supports a cornice, the lower edge of which stands out from the wall for a distance of about an eighth of an inch. Perforations are made in the outer flange, so that, whenever the water in the gutter rises above the orifices, it will escape and flow down the walls.

A suitable waste pipe, C, Fig. 1, connects with the gutter, and ordinarily carries off the water to the sewer; but when it is desired to cause an overflow through the perforations, as above noted, the shutting off of a cock, at D, accomplishes the object.



FIRE EXTINGUISHING APPARATUS FOR BUILDINGS.

Under the lower floor, and inside the walls of the building, it is designed to place four distributing mains, one of which is shown at E, Fig. 1. From each corner, formed by their junction, rises a stand pipe, F, to and through the roof, terminating in a hose coupling, Fig. 2. Under the roof horizontal pipes, G, connect the stand pipes together, and these, as are also the mains, E, are provided with suitable stopcocks, by means of which water may be delivered at any one or more of the stand pipes upon the roofs, or without pressure through all the pipes. One stand pipe terminates at the plane of the roof, and serves to conduct water therefrom except when flooding is desired, when a stopcock at the lower part of the tube is closed. At the planes of the joists of the several floors, the stand pipes are tapped with couplings with which to connect perforated pipes extending across the building, for the purpose of throwing spray between the floors and ceilings to extinguish fires occurring therein. These spray tubes are provided with stop valves at each end, so that no water need be used unless required.

In the center of the roof is a pipe, H, extending through the same and having hose couplings at both ends. The upper extremity may be connected by a hose with one of the stand pipes; and, by hose attached to its lower portion, water may be delivered at any point within the upper story. The stand pipes are provided with external couplings at the several floors, which project through the outer walls to receive lines of hose from fire engines, as shown in Fig. 1.

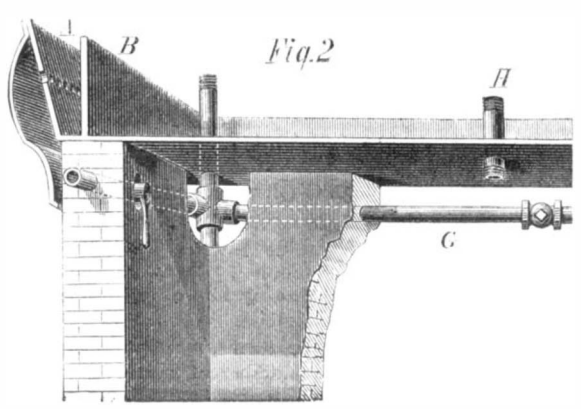
The inventor suggests that the device will prove a valuable safeguard in theaters and other buildings liable to sudden conflagration. He proposes to make the sides of proscenium boxes, and also the railing of each balcony, of galvanized metal with perforated surfaces, so that a flow of water may be instantly secured, which will flood the auditorium.

Patented January 20, 1874. For further particulars regarding sale of rights address the inventor, Mr. John C. Schweizer, with Kramer Brothers, 264 and 266 Madison street, Chicago, Ill., or Francis Probst, 51 Liberty street, New York city.

Carnivorous Plants.

In a recent number of the *American Naturalist*, Mrs. Mary Treat gives an interesting account of her observations of the habits of the plant known as sundew (*drosera filiformis*), which she found in July last, in Atlantic county, N. J. These plants appear to be most remarkably endowed. To all the usual functions of plants, certain animal instincts and propensities are added, such as the power to seize, kill, and suck the blood of insects, and to grasp and eat raw meat, etc.

Our author says of the plant: It was in full bloom and growing as thick as it could well stand, on either side of an extensive cranberry plantation. This charming plant, with its pretty pink blossoms, together with the dew-like substance exuding from the glands (the glands surmount the bristles or hairs which cover the long thread-like leaves), was one of the most beautiful sights I ever beheld. From



former observations I had supposed this plant caught only small insects, but now found I was mistaken; great asilus flies were held firm prisoners, innumerable moths and butterflies, many of them two inches across, were alike held captive till they died—the bright flowers and brilliant, glistening dew luring them on to sure death. But what is the use of this wholesale destruction of insect life? Can the plants use them? Upon examination I find that, after the death of the larger insects, they fall around the roots of the plants as if to fertilize them, but the smaller flies remain sticking to the leaves.

Careful and repeated experiments during several days revealed the fact that on some days the plants work much better than on others. Whether it was the electrical condition or amount of moisture in the atmosphere is yet to be ascertained.

I experimented with three species of these plants—*d. filiformis*, *d. longifolia*, and *d. rotundifolia*.

July 11, 10 o'clock, A. M., I pinned some living flies half an inch from the leaves, near the apex, of *d. filiformis*. In forty minutes the leaves had bent perceptibly toward the flies. At twelve o'clock the leaves had reached the flies, and their legs were entangled among the bristles and held fast. I then removed the flies three quarters of an inch further from the leaves. The leaves still remained bent away from the direction of the light toward the flies, but did not reach them at this distance. Whether the action of the flies' wings may have created sufficient force to bring the leaves near enough to entangle the flies, is a question I have not yet satisfactorily settled in my own mind, for dead flies did not seem to have the same power as living ones.

Fifteen minutes past ten of the same day, I placed bits of raw beef on some of the most vigorous leaves of *d. longifolia*. Ten minutes past twelve, two of the leaves had folded around the beef, hiding it from sight. Half past eleven of the same day I placed living flies on the leaves of *d. longifolia*. At twelve o'clock and forty-eight minutes, one of the leaves had folded entirely around its victim, and the other leaves had partially folded and the flies had ceased to struggle. By half past two, four leaves had each folded around a fly. The leaf folds from the apex to the petiole, after the manner of its venation. I tried mineral substances, bits of dry chalk, magnesia, and pebbles. In twenty-four hours neither the leaves nor the bristles had made any move like clasping these articles. I wet a piece of chalk in water, and in less than an hour the bristles were curving about it, but soon unfolded again, leaving the chalk free on the blade of the leaf.

The bristles around the edge of the leaf of *d. rotundifolia* are longer than on those of *d. longifolia*, but the leaf of the former does not fold around a fly as it does in the latter—simply the bristles curve around the object, the glands on the ends of the bristles touching the substance, like so many mouths receiving nourishment.

Half past 10, A. M., I placed raw beef on some leaves of *d. rotundifolia*; by 1 o'clock the inner bristles were curving about it, and the longer bristles, on the outer edge of the leaf, were slowly curving upward. By 9 o'clock, in the evening, all the bristles of three of the most vigorous leaves were clasping the beef, almost hiding it from sight, while an equally vigorous leaf made no move like clasping a bit of dry chalk. At 10 o'clock in the morning I placed bits of raw apple on some of the leaves of the last named species; by 9 o'clock in the evening part of the bristles were clasping it, but not so closely as the beef. By 10 o'clock next day, twenty-four hours, nearly all the bristles were curved toward it, but not many of the glands were touching it. So it would seem that these plants are really carnivorous, that they prefer and absorb animal substances through their leaves. And Mr. Darwin says that by pricking a point in the leaf of *drosera*, he can paralyze half of it, and this indicates nerves!

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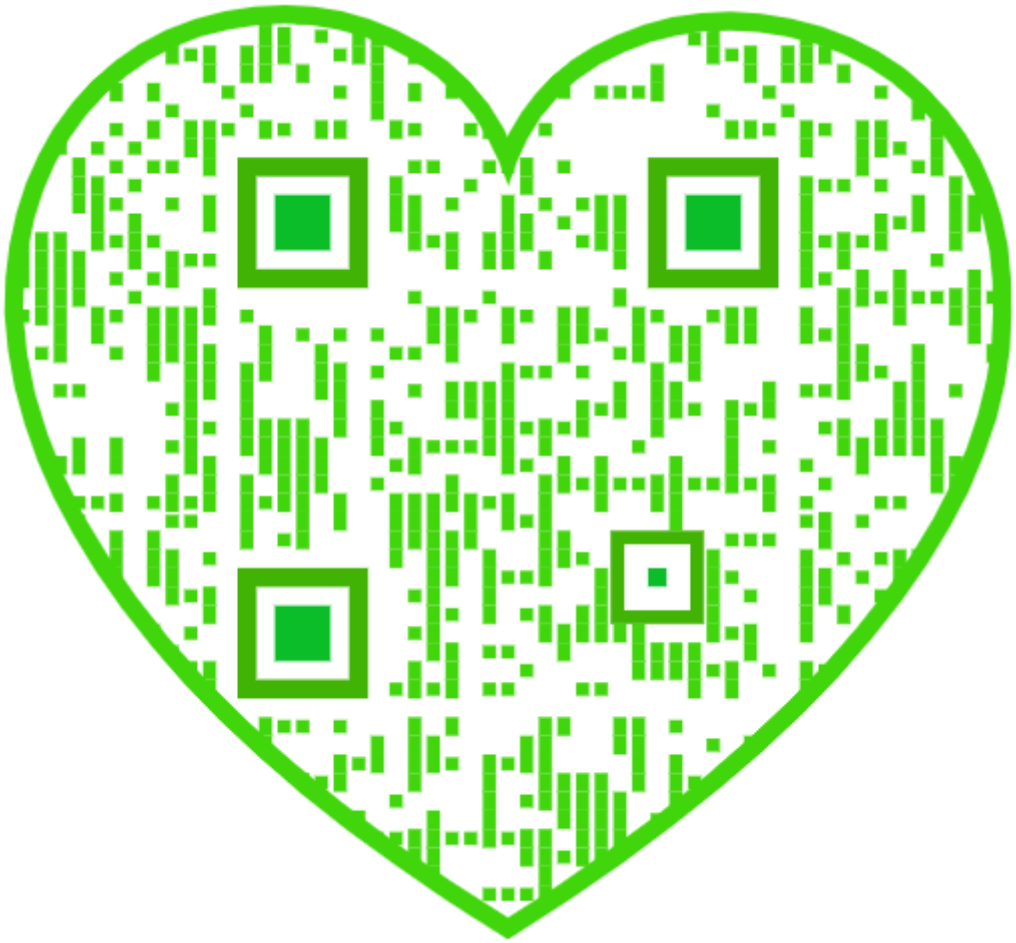

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year..... $3 00
One copy, six months..... 1 50
CLUB RATES { Ten copies, one year, each $2 50..... 25 00
{ Over ten copies, same rate, each..... 2 50

VOLUME XXX, No. 14. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, APRIL 4, 1874.

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THE SCIENTIFIC AMERICAN AS A PREVENTIVE OF BOILER EXPLOSIONS.---VALUE OF ITS CORRESPONDENCE.

Our readers, in their kind letters of commendation of the SCIENTIFIC AMERICAN, very frequently tell us that the information they derive from its columns is of the greatest value to them in their several callings, and every day we are told that a single hint put in practice is often the means of making or saving considerable sums of money. Of course these flattering testimonials are very gratifying to ourselves, and we are glad to know *how* the money was saved or earned: whether, in fact, the writers measure the amount of practical information they gain in dollars and cents, and then are unable to think of any sum which will adequately express its value, or whether from its columns they obtain ideas which enable them to improve the quality of their work, and so derive increased incomes; or whether, in some special instance, a direct gain can be traced or an accident avoided. Sometimes, however, a correspondent enlightens us, and sends an item which is not only interesting to the editor, but serves a useful purpose to others. A letter now before us is an excellent example in point.

Mr. S. E. Worrell, of Worrell, Hannibal county, Mo., writes that he has read the SCIENTIFIC AMERICAN for fourteen years, and that he has learned more from its pages than during the period he attended school. In perusing a recent number, he goes on to state, his attention was attracted by the report of boiler inspections by the Hartford Boiler Insurance Company. "On glancing over the article, I remembered," he writes, "that I had not heard the escape of steam from our safety valve for some time. Upon going to the mill the next morning and on making an examination I found that the valve would not rise even with the steam gage standing at 120 pounds and the weight off the lever. I even had to knock the lever up with a hammer, and then could not get it back until the steam was entirely out of the boiler. I afterwards found the valve stem had become rusted in the cover of the valve. Our boiler is only a small one, but its explosion might have caused the loss of a number of lives and of much property."

We congratulate our correspondent on his narrow escape from a probable casualty. We commend him for his careful attention to what he reads. If every mechanic, on receiving a number of the SCIENTIFIC AMERICAN, would thoroughly consider its suggestions, and seek to apply them to his individual case, there is no doubt but many of the disasters occurring in the use of machinery would be avoided. The information imparted by practical men in their various callings in the correspondence columns of this paper is of great value to all classes of readers, coming, as it does, from the experience and observations of those willing to impart hints beneficial to others, expecting, in return, that others will communicate information of benefit to themselves.

We would suggest that this feature of the paper may be made still more useful and interesting, if every subscriber will take the trouble to communicate some new fact or discovery he has made, whether by accident or experiment.

A few lines of such information from the workshop are frequently of more practical value than a volume of essays on some abstract science by the most learned author. Certainly every subscriber can furnish during the year at least one item of interest. This will give nearly fifty thousand facts from as many different sources, which would furnish, in the aggregate, an amount of information not otherwise attainable.

THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS.

Those of our readers who are familiar with the course of events during the strike of railroad engineers, which occurred, principally on western lines, some two months since, will remember that the demonstration elicited a strong letter of disapproval from Mr. Charles Wilson, Grand Chief Engineer of the Brotherhood of Locomotive Engineers. This document, which went the rounds of the public press, while unreservedly condemning the movement, also stated that such action on the part of members of the above named association was in direct opposition to the principles and practices of their organization. To the opinions thus plainly expressed, and to the influence exerted by Mr. Wilson, the failure of the uprising may be in no small measure attributed; and hence to his good sense, moderation, and just views is mainly due the prevention of imminent losses to both contending parties. It would naturally be thought that the men engaged in the controversy, even if rendered somewhat irrational at the time by the incident excitement, would on sober second reflection perceive the sound reason in Mr. Wilson's action; and consequently, if they did not feel a certain amount of gratitude for his clear-headed advice, would at least tacitly recognize the justice in the position he had assumed. But not so the locomotive engineers. Having called a convention at Cleveland, Ohio, recently, they proceeded to arraign the course of their president. So far as we can learn from the reports of the meeting, the discussion was carried on principally by noisy individuals who had been foremost among those fomenting the past disturbances. However this may be, the result of the deliberations was far from evidencing either the common sense or the justice of the delegates; for, by an almost unanimous vote of 120 to 18, the acts of the strikers were approved and Mr. Wilson requested to resign his presidency of the order.

The locomotive engineers of this country are as a rule an able and thoroughly reliable body of men. To their hands are entrusted immense responsibilities, and from them are required the exercise of an amount of skill, cool judgment, and, at times, absolute heroism which raise them far above the average mechanic. Of how uniformly they have met and do meet all these requirements, their past record, coupled with the small percentage of railway casualties yearly occurring in this country (considered in relation to those happening elsewhere) offers abundant testimony. It is in view of these very facts, however, that we find ourselves at a loss for an explanation of the action above noted. Are we to understand that the men to whom are hourly entrusted hundreds of lives and property of untold value mean deliberately to endorse the malicious acts of the wretches who misplaced switches, who shot workmen down at their posts, who disabled machinery, and committed other wilful and malicious crimes against not merely their employers, but against the entire community? If such be the inference, (and we can form no other from the strong evidence of the vote, on the one hand and the letter which gave rise to the convention, on the other), then the Brotherhood of Locomotive Engineers as it now stands has as an organization manifestly survived its time of usefulness, and the sooner it disappears from the public gaze the better. It has sunk down to the level of those who perpetually seek to promote disorder by the thread-bare arguments of eternal antagonism between employer and employed, and to have submitted itself to the leadership of the violent extremists who somehow contrive to creep into the counsels of nearly every trade organization.

Mr. Wilson, we understand, proposes to appeal to the Brotherhood as a whole, against the action of their delegates, and invites such members as do not acquiesce in the course of the latter, to join him in forming a new society on the old basis, as expressed in the letter referred to in the beginning. We trust that this invitation will meet with a cordial response from every right-minded man in the Brotherhood; and that for their own sakes, if only to relieve their reputations from the slur which the convention has cast upon them, the large majority of the members will hasten to repudiate the disgraceful vote of their representatives.

THE MARVELS OF MECHANICS.

During the last siege of Paris, the inhabitants from time to time effected communication with their friends beyond the German investing lines by means of carrier pigeons. In fact, a regular pigeon post was organized, having one of its receiving stations in London. Here the written messages for Paris were received, and, by photography, reduced to microscopic size, each letter being reduced so small as to be invisible to the eye except as a speck. Some two thousand of these specks were then printed on bits of tissue paper about an inch and a half square, which was rolled and carefully attached to one of the tail feathers of the pigeon. On the arrival of the bird in Paris, the postal officials placed the paper under the microscope, which enlarged the several specks into readable communications, which were duly copied in writing and delivered to the persons to whom they were addressed. The total postage received for the transmission of one of those tiny bits of paper frequently amounted to two thousand dollars.

Small as this photo writing seems, it has been surpassed by mechanism. In a recent number of the *Lens*, Dr. J. J. Woodward, U. S. A., gives an enlarged photograph of microscopic writing done by machinery on glass, by means of a diamond, executed by Mr. William Webb, of London. The writing consists of the Lord's Prayer, which is written upon glass, within a space equal to one two hundred and ninety fourth part of an inch in length by one four hundred and fortieth part of an inch in width, or a space perhaps equal to the dot in this letter i. The photograph given by Dr. Woodward shows this dot of writing enlarged so as to occupy a space of about two inches long by one and a half inches broad. All the words are brought legibly out on the photograph, the total number of letters being 227; and such is the exceeding fineness of the original writing that 29,431,458 letters written in the same way would only cover one square inch of glass surface. The combined Bible and New Testament contain in all 3,566,480 letters; hence it would be possible for Mr. Webb to write the entire contents of more than eight bibles within the space of one square inch. Two specimen plates containing the microscopic writing above alluded to have been supplied by Mr. Webb for the United States Museum at Washington. Their cost was fifty dollars each.

The Webb machine, however, does not equal, in the fineness of its writing or perfection, the prior instrument of Mr. N. Peters, a wealthy banker of London, who, as long ago as 1855, was able to write nearly three times finer than Webb. So perfect was the Peters machine that it was competent to engrave the entire contents of the Bible and New Testament twenty-two times over within the space of a single square inch.

METROLOGICAL SCIENCE.

The American Metrological Society, the first session of which was held during December last in this city, forwards us a copy of its constitution and by-laws, in which the objects of the association are fully set forth. These, briefly, are to improve the system of weights, measures, and moneys at present existing among men, and to bring the same as far as practicable into relations of simple commensurability to each other. The universal adoption of common units of measure for the expression of quantities which require to be stated in presenting the results of physical observations or investigation, and for which the ordinary systems of metrology do not provide, is also to be advocated, and it will be the effort of the society to secure, in regard to the denominations of weight, measure, and money, the acceptance of the decimal system.

President Barnard, of Columbia College, has been elected President, and the names of several well-known scientific gentlemen, including Professors Hilgard, Newton, Cooke, Elliot, and Thurston are among the officers and council. The association has already begun its labors and has prepared two memorials to Congress which are now open for signatures of all persons interested in their objects. In 1866, Congress legalized the use of metric denominations, and in the recent coinage act the weights of all silver coins of the United States, except the trade dollar, are thus set forth. The first memorial prays that means be taken by suitable legislation to introduce the metric system more directly into, while not interfering with, the general business of the people. The passage of laws is urged, rendering the system obligatory to the Post Office Department; in reports of public works conducted under authority of the Federal Government; in all statistical or other documents involving statements of quantities, issued under similar sanction; and in the estimation and computation of custom duties of the United States.

The second memorial refers to the legal weights of our gold coinage, and asks that the pure gold contained in the dollars shall be exactly one gramme and a half. The *Engineering and Mining Journal*, in commenting on the subject, adds that it is only necessary that the fineness of standard gold should be everywhere nine tenths (as it is everywhere already, except in Great Britain), that the weight of pure gold in coins should be given on the coins in metrical units, and that the mints of civilized countries should do honest work: when the immediate results would be that the gold coins of nations adhering to the plan could safely be made legal tender in exact proportion to their weight.

The gramme of pure gold would thus become the world's unit of money, and the problem of an international coinage thus quickly and easily settled.

THE DETROIT RIVER TUNNEL.

An interesting history of the attempted construction of the tunnel under the Detroit river, between Detroit and Windsor, on the Canada shore, is given in a paper read by Mr. E. S. Chesborough, C. E., at the last annual convention, and published in the Transactions, of the American Society of Civil Engineers. Up to July, 1872, it seems that the prospects of the work were quite favorable; but in the latter part of that month, when excavation at the Windsor end had progressed about 250 feet through hard ground, a sudden irruption of sand and water occurred, which threatened to fill the tunnel out to the sump and choke the pumps. Three bulkheads were built, each nearer the shaft, and the last one quite close to the same, before a successful stand was made. After a delay of several days, operations were resumed; but hardly had thirty feet of new tunnel been made when another irruption ensued, and again bulkheads were resorted to. After beginning once more, a third break followed, and finally a fourth, when the contractors, finding that the work was costing four times the price they received for it, determined to make a lift shaft at the end of the drift on the Windsor side and start a new drift 10 feet higher than that of the drainage tunnel. This was done; but the irruptions again appeared, coming from the bottom instead of the top of the excavation, there being a vein of sand at the level of the top of the lower drift. Finally, after advancing 370 feet from the shore shaft, it was decided to abandon progress in that direction.

On the Detroit side, other difficulties were being encountered. At 1,180 feet from the shaft, the ventilating apparatus proved inadequate and two of the workmen were killed. At 1,220 feet (new machinery having been established) the

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influx of water became so great as to require more powerful pumping engines, and then the contractors, discouraged, sought and received permission to relinquish the work.

Then the directors attempted to continue on the Windsor end by means of two parallel trial drifts, and to begin a second one at the shore shaft, at a level 10 feet above the grade of the drainage tunnel, leaving the latter to be used as a sand holder in case of further irruption, the idea being that, in either one or the other drift, some progress might be made. Experience, it seems, had shown that a stream of sand and water flowing into the tunnel at one point would never be accompanied by a troublesome one flowing in at another. It is unnecessary to enter into the details of the last effort. The actual advance in new ground during the last two months was only 64 feet, and the cost about $7,500, or more than 6½ times the contract price, and the directors, in turn discouraged, abandoned the enterprize.

Mr. Chesborough answers various criticisms on the mode of carrying on the work, and states reasons why the orifices through which the irruptions occurred could not be stopped. A shield, he remarks, could not be used to advantage, nor could success have been assured by the pneumatic process. The causes of the irruption were springs and water courses, having their source 100 feet higher than the tunnel, and much above the level of tide water. Mr. McAlpine notes a similar case in the building of the dry docks at Brooklyn, N. Y., where fresh water came in with a head of 50 feet higher than that of the salt water. The water entering at Detroit was sulphur water, and without doubt owed its origin to Sulphur Springs at Sandwich, below Detroit, where the level rises from 30 to 40 feet above that of the river.

A HILL OF SULPHUR.

One of the most remarkable deposits of native sulphur, as yet discovered, is a great hill composed of the almost pure article, found some two years ago at a distance of thirty miles south of the Union Pacific Railway and nine hundred miles west of Omaha. This marvelous deposit is found to consist almost wholly of sulphur, containing only 15 per cent of impurities. The best deposits heretofore available are those found in Sicily. The principal supplies for the manufacture of sulphuric acid come from there; the deposits contain 35 per cent of impurities and 65 per cent of sulphur. Our western sulphur hill, therefore, is much the most valuable, and promises to become ere long of great importance to the country.

THE LAUNCH OF THE CITY OF PEKING.

The country has good cause for self-congratulation in the efforts which our prominent shipbuilders and capitalists are putting forth to regain the commerce which, during the war, passed from under our flag. Another great vessel has been launched, one of the largest ships ever constructed, save the Great Eastern, which is to form part of the Pacific Mail steamship line; a second vessel of similar proportions is on the stocks, and the same builders, we learn, are maturing plans for a line of European steamers. The City of Peking, which was recently successfully launched at Chester, Pa., was constructed by the Delaware River Iron Shipbuilding and Engine Works, of which Mr. John Roach is President, and is without doubt one of the most magnificent vessels, in construction, form, and fittings, ever built. Her length is 420 feet, beam 47 feet 4 inches, and tunnage 6,000 tuns. She has compound engines of 4,500 horse power, and a Hirsch four bladed screw 20 feet 3 inches in diameter. There are four decks, with accommodations for 2,000 passengers, fitted up in almost palatial style. No improvement in interior conveniences has been omitted; the machinery, soon to be inserted, is said to be a masterpiece of workmanship.

The ship is entirely of iron, five million pounds of the metal being used in her hull. She has four masts, three of which are of iron and are used as ventilators, and she spreads 33,000 square feet of canvas. Her estimated consumption of coal under her ten boilers is estimated at between fifty and sixty tuns per twenty four hours, and her speed will be about fifteen and a half knots.

The ceremony of launching was made the occasion of a holiday in Chester, and the town was thronged with visitors from New York, Philadelphia, and Washington. Large numbers of prominent men were present, including senators, representatives, chiefs of bureaus and other government officials. The ship, as the last shore was removed, glided into the water in splendid style, and was duly christened by the daughter of the builder, breaking the traditional bottle of wine over the bows. Speeches were afterwards made by Senators Cameron and Bogy, and by Mr. Roach, the latter gentleman detailing the operations of the company since its formation two years ago. The City of Peking will be commanded by Captain Jefferson Maury, and will shortly be brought to this city to receive her machinery at the Morgan Iron Works.

THE CHARACTER OF METALS AS EXHIBITED BY THEIR FRACTURE.

BY PROFESSOR R. H. THURSTON.

In an article published in the SCIENTIFIC AMERICAN of January 17*, a series of finely executed engravings illustrated the value of an inspection of the fractured surfaces of test pieces of metals broken by torsion as a means of judging of their character.

During the research there referred to, of which the results are given at length in a paper now in course of publication by the American Society of Civil Engineers, in the "Transactions" of that society†, the effect of various changes of condition, in production of alteration in the characteristics of fracture, has been found to present an interesting and useful study.

Referring to that article, the reader will observe the marked difference between numbers 16 and 22 as exhibiting the effect of a difference in thoroughness of working, the former being a good iron badly worked, and the latter being the most perfectly worked piece of iron which has ever come under the observation of the writer. Nos. 23 and 30 show the difference between a cast iron highly charged with carbon and a specimen containing a minimum percentage, while still other illustrations exhibit the low steels 58, 68, 71, containing only iron and a low portion of carbon, and the malleableized cast irons, 33, 35, which are steels which retain the impurities of cast iron, and are somewhat irregular in structure.

The effect of cold upon the properties of iron has been but little understood. One party of experimenters claim to have proven an increase, others a decrease, of strength with decrease of temperature. In a paper, originally prepared for the *Iron Age** and since republished by several other periodicals,† the writer collated such information, as then existed, from both scientific and engineering authorities, which showed that the general effect of low temperature seemed to be a decrease in power of resisting blows and an increase in power of resisting a steady strain, these seemingly contradictory effects being the consequence of increased tenacity accompanied by a simultaneous and yet greater decrease of ductility. Subsequent experiments by the writer, with the autographic testing machine designed by him for the Stevens Institute of Technology, in which errors of observation are avoided by so arranging the apparatus that the specimen tested shall write legibly its own story, have to some extent confirmed those deductions, but have revealed some reversals of the rule and have indicated that good materials are better in both respects at temperatures not far removed from zero.

The paper referred to was called forth by the request of the editor of the paper in which it first appeared, to whom Mr. Oliver Williams had forwarded a specimen of metal which had been broken at one point at a temperature of 75° Fah., and at another place when at a temperature of 20°. This specimen was afterwards placed in the cabinet of metals and minerals, in the lecture room of the writer, at the Stevens Institute of Technology. The method of fracture is stated to have been precisely the same in each case. The difference in appearance is very remarkable. The fracture at 70° is a strikingly perfect illustration of the fibrous, as that at 20° is of the granular, fracture.

Judging from general experience, I should be inclined to consider this iron far less reliable in cold than in warm weather. Careful experiment, however, is daily convincing engineers that the distinction, here so well shown, is a far less reliable indication of the strength and ductility of iron than was formerly supposed.

A kind of fracture which is probably always indicative of brittleness is generally, and possibly correctly, termed crystaline. It is supposed to be produced by a long continued succession of shocks, which, straining the metal to the elastic limit, permit the crystaline grouping of molecules to take place. Dr. Percy, the leading metallurgical authority of the world, seems to have been fully convinced of the possibility of the formation, in this way, of true crystals; but direct experiment is still desirable to fully determine it. A singular instance of this peculiar molecular action recently occurred at the Morgan Iron Works, New York. While a powerful steam hammer was at work upon the red hot end of a very large shaft, originally designed for the engines of a large naval steamer, a piece of the opposite end, which was cold, and which was supposed to be strong enough to transmit several thousand horse power, dropped off. This was an extraordinary event, but not unprecedented. In all such instances, the fracture seems to follow a plane passing through a comparatively sharp angle at the side of a collar or at the end of a journal.

The effect of cold is not always observable, particularly with ductile iron, of which two specimens were tested, one, at 10° Fah., and the other at 70° Fah. The metal was a cheap grade of wrought iron, quite cold-short, and very irregular. Two specimens from the same bar of good tool steel were also tested, one having been broken at 18° Fah., and the other at 70°.

The purest irons and low steels, and even the shear steels, do not usually show a change in form of fracture with change of temperature. At all temperatures likely to be experienced in this latitude, at least, they are equally reliable.

Two specimens of copper were also tested. The first was cast in dry sand and broken at 10° Fah., the second was cast in green sand and broken at 70°. The beautiful crystaline structure of the former is apparently due, principally, to low temperature. The unsound structure of the latter is the consequence of using a damp mold, and exhibits the advisability of using dry sand whenever possible. The two are very characteristic specimens. Copper is strongest at low temperatures and seems to lose none of its ductility. Forged specimens of copper, in all but color, resemble, when fractured, the toughest and most ductile kinds of iron.

The wonderful difference in properties of steel, under different methods of treatment, is shown by two specimens from the same bar of fine cast steel. The first has been carefully annealed, the second as thoroughly hardened. The close resemblance of the former to the low steels, shown in the former communication, was at once noticed. It does not appear like a true steel, not having even the faintest resemblance to the hardened specimen, which presents the uneven fracture and fine grain characteristic of the best tool steels.

Still another illustration of a peculiar modification of iron produced by special methods of treatment is seen in a piece of iron which had been subjected to the process of cold rolling. The effect of this action is to produce a marked increase of strength and of elasticity. In precisely what way this effect was produced was long a disputed point. No change of density had been detected, and some of the most talented and distinguished scientific men and engineers who had occasion to examine this singular material, as members of the International Jury at the Vienna Exhibition, found it exceedingly difficult to credit the claims made for it, although sustained by reports of experiments made upon it by well known authorities at home and abroad.

It has lately been shown by the writer that the effect of cold rolling is to render the iron more perfectly homogeneous and to produce such a disposition of internal strains as to greatly increase its elastic resistance.*

The thready appearance of the side of the broken specimens, and the toughness and compactness, of which good evidence is seen by an inspection of the end of the test piece, are the peculiar characteristics of this material. Those of the readers of the SCIENTIFIC AMERICAN who have occasion to adopt the method of testing metals, described in the issue of January 17, will be interested in learning the effect of varying the proportions of copper, tin, and zinc, in bronze, brass, and other compositions.

An alloy of ten parts copper to one part tin has two thirds the strength of iron and about one half its ductility. Such a metal is very valuable wherever strength and toughness are required in a cast metal. An increased proportion of tin produces increased hardness and a loss of ductility. Sixty-nine parts copper to thirty-one parts tin is an alloy which is very hard and as brittle as glass. Increasing the proportion of copper gives greater ductility at the expense of strength, and castings become liable to unsoundness.

Zinc is a brittle metal of crystaline structure, and vastly different from tin. Yet an alloy of zinc and copper may be made of considerable strength and of great ductility, as is the case with wire brass where the proportions are about two of copper to one of zinc, and with an unusually beautiful special grade of brass made at the Stevens Institute. This specimen exhibits characteristics common to all the more ductile alloys as well as of the metal tin. The curious, irregularly wavy appearance of the exterior, and the half fibrous, half granular fracture, are seen in gun metal, soft brass, oroide, phosphor bronze, and many other alloys which have been tested. Metal workers often make a free working and fine looking alloy by uniting copper, tin, and zinc. For some purposes such a mixture is well adapted, but it often happens that, without suspecting it, the workman seriously injures his material by adding, for appearance sake, zinc to a bronze in proportions seemingly too small to effect its mechanical properties.

The writer has found the addition of but a fraction over one per cent of lead, to a good brass, to reduce its strength nearly a half, and to cause a corresponding loss of ductility, thus making it but about one fourth as valuable in resisting blows as the clean alloy.

A good bronze, containing about ten of copper to one of tin, to which less than three per cent of zinc was added, was also tested in comparison with a brass in which lead was thus a component. The former is a metal of fine looking exterior, works well and takes a good polish. Its strength is slightly increased by the addition of the zinc, but its ductility is hardly a sixth that of the pure copper and tin alloy. The fracture shows this change to the eye with unmistakeable clearness. Instead of the toughness and extensibility shown so plainly in the specimen with lead in it, is exhibited a ragged, dull, irregular break like cast iron.

Such experiments as these are exceedingly instructive; and every worker in metals, every iron and brass founder, would find himself well repaid for time expended in such researches by the discovery of the mixtures best fitted for his work; and if each were to make public the results of his work, whenever evidently important, he would benefit the world without loss to himself.

Dr. Arnott.

The decease is announced of the celebrated Dr. Neil Arnott, at the advanced age of eighty-five years. He was not only a physician of eminence, but an author, a scientist, and an inventor. His "Elements of Physics," published in 1827, was largely circulated, and greatly promoted the study of the sciences. His researches upon warming and ventilation, and his inventions of stoves and ventilators, have greatly added to human comfort, and have led the way to various other important discoveries. Dr. Arnott was the recipient of many honors, and no one more justly deserved them. His life was a most useful one.

TO NEW SUBSCRIBERS.

It has been our custom to commence at the beginning of the year, all subscriptions received previous to the first of April, and to send the back numbers from the first of January. Hereafter the paper will be sent from the date of receipt of subscription; but to those who wish them, the back numbers from the commencement of the volume will be furnished, and the subscription dated from the first of the year.

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*Testing the quality of iron, steel, and other metals without special apparatus.

†March 1874, *et seq.*

Iron Age, June, 1873.

†*Van Nostrand's Engineering Magazine* July 1873; *Journal of the Franklin Institute*, September, October, 1873; London *Iron*, January 1874, etc.

*Trans. Am. Soc. C. E., March, 1874.

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THE PALÆOTHERIUM MAGNUM.

The palæontological collection of the French Museum of Natural History has recently been enriched with a new fossil of the highest scientific interest. It is an entire skeleton of the *palæotherium magnum*, found incrusted in the quarries of Vitry-sur-Seine. Our engraving is reproduced from a photograph taken in the galleries of the excavations by means of the electric light.

The animal was first described by Cuvier, and was a mammifer, now entirely extinct and indeed without any actual representative among existing creatures. At one period its species was extremely abundant. Modern geologists classify it with the rhinoceros, the tapir and the horse; but their views have heretofore been based only on the detached bones, which have become common objects in almost every collection. The examination of the complete skeleton, now for the first time discovered entire, shows that even Cuvier was wrong in ascribing to the animal the proportions and conformation of the tapir. So far from being massive and heavy in build, as has been supposed, the palæotherium was a light, graceful animal, with a neck longer than that of the horse and closely resembling in external form that of the llama. Three toes are counted on each foot, and there is a snout or rudiment of a trunk. The femur has a third trochanter. The dentary system is composed of six incisors, four canines and fourteen molars, the last being analogous to the similar teeth of the rhinoceros. The hight of the animal was a little less than that of the medium horse. It was herbivorous, and existed in vast herds during the middle of the eocene period, as its remains are found in gypsum and equivalent rocks formed during that stage of the world's history.

THE PALÆOTHERIUM MAGNUM.

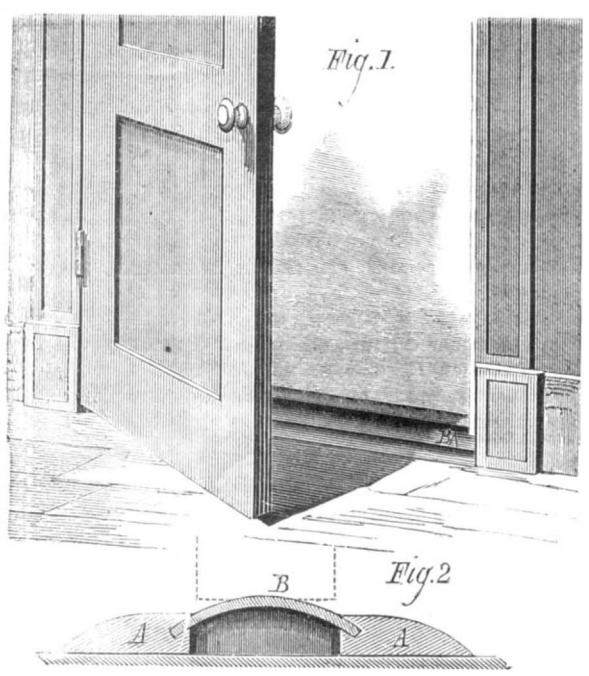
Galvanic Electricity.

Put a rod of amalgamated zinc in a glass cell filled with dilute acid, and it will be seen that the apparent action is limited to the gradual production of a few bubbles of gas. On placing this copper wire in the cell beside the zinc, there is no change until I allow the two metals to touch, when you see torrents of bubbles are evolved from the surface of the copper wire. On substituting platinum or silver for the copper we get a similar effect, and that whether we join the metals within the liquid or at a point exterior to it. Thus, if I join the copper wire to this galvanometer, and connect the other end of the coil with the zinc rod, you see that the magnetic needle is deflected as long as contact continues; but immediately on breaking the circuit, the action on the needle and the evolution of bubbles cease instantly. Such an arrangement of two metals, in a liquid capable of acting on one of them, is called a galvanic battery, and by means of it, in connection with a very delicate galvanometer on the other side of the Atlantic, we are able to send telegraphic signals across the ocean.

From the fact that the bubbles of gas are given off from the surface of the copper, we might suppose that it was that metal which was acted on; but if we were to weigh them, we should find that it was the zinc which had lost weight, while the copper remained quite unacted on. The dissolved metal is known as the positive, and the unacted metal as the negative; in fact, there is less tendency to solution on the part of the copper when connected with the zinc than in the absence of the latter metal, which, on the other hand, is far more rapidly dissolved than it would be alone.—*Lecture by A. H. Allen, F.C.S.*

IMPROVED ADJUSTABLE THRESHOLD.

Prolific causes of cold feet, consequent colds, and soiled carpets, are cracks under doors, between the bottom and the threshold. As a remedy for this trouble, a very simple device has been suggested, and has, as we are informed by the manufacturers, been in use for some four years past in Chicago, with perfect success. It consists, simply, of a strip of heavy rubber, B, let into hard wood pieces, A, and securely fastened, thus forming an arch in the center, as will be seen from the sectional view, Fig. 2. When the threshold is in place, the rubber arch presses gently on the bottom of the door (dotted lines, Fig. 2); when closed, across the whole width, entirely excluding, it is claimed, rain, cold, dust, etc.

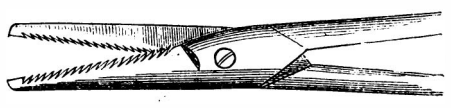


The device is said to be very durable, and to outwear wooden thresholds. It cannot get out of order and is easily swept over.

We learn that it is now being introduced in other sections of the country for the first time, and is meeting with ready application. Further particulars regarding sale of rights (State or county) can be obtained by addressing Wilson, Peirce, & Co., 182 Clark street, Chicago, Ill.

Tooth-edged Cutting Scissors.

Dr. B. W. Richardson says: I have recently had constructed for my use a pair of tooth-edged cutting scissors, on the



plan shown in the diagram. The scissors are of the ordinary construction, in all respects, except in the cutting edge. The cutting edge of each blade, instead of being even and sharp, is divided into finely pointed teeth, each tooth being directed with a slight inclination towards the handle of the scissors. When the blades meet, the teeth cross each other; and as they pierce any structure that may lie between them, they crush also, between their surfaces.

If a piece of moderately firm substance be placed between the blades—a piece of paper or thin card, for example—the scissors perforate it in a series of perforations resembling what is seen in the postage stamp; that is to say, they do not cut clean through the substance, so as to leave it in two distinct parts at once. A little lateral or half-rotating movement of the closed blades is, however, sufficient to tear through the still connected lines of substance and to complete the separation. The same occurs if the substance placed between the blades be a portion of soft animal structure, only that more force is required in the lateral or rotating movement to cause complete separation. The parts punctured are crushed between the teeth, and are separated by the twist or torsion.

I find these scissors useful in dividing, directly and quickly, structures in which there are many minute blood vessels, and which, when divided by the knife, bleed freely. These toothed scissors, as they can be made at one and the same time to pierce, crush, and twist, control bleeding remarkably.

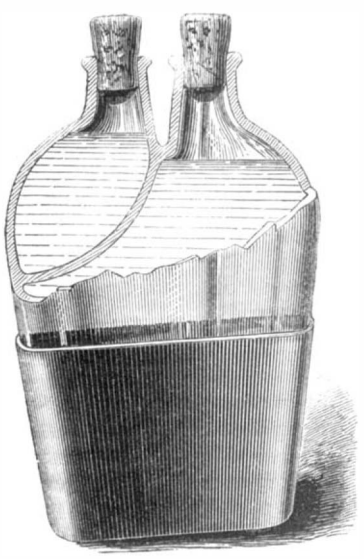
I have put the scissors to a good test in a case of epulis. The tumor was increasing rapidly, and three teeth were involved in it. It was very vascular, had a broad base, and might, at first sight, have been taken for a malignant rather than for a fiberous tumor. The three teeth being extracted, I found I could get a deep grasp of the tumor between the blades of the scissors. I carried the teeth of the scissors well through the base of the tumor, crushing some portion of bone in the way, and gently and easily twisted the mass off, and lifted it away upon the blades without the loss of any blood whatever. The healing in this case was rapid and good. —*Medical Times and Gazette.*

Iron Columns.

At a recent meeting of the members of the London Architectural Association, Mr. Richard Moreland, C.E., read an important paper on "Iron Construction," in which he said that, with regard to cast iron pillars in long columns, the tranverse section had two duties to perform, namely, to support the load and to resist flexure, so that only one half of the strength of the pillar could be considered available for the resistance to crushing, and the other half for the resistance to flexure. In other words, one half was in compression and the other half in tension; and this was precisely the condition in which a girder was in; or it might be taken as a question of leverage, the length of one end being the diameter of the pillar, and the other half length of the column; but in the case where the pillar was large in comparison to its length, then the whole of the material must be taken to resist the compression of a considerable portion of its crushing strength. The working load on pillars should not exceed one tenth to one sixth of their breaking, and, under ordinary circumstances, should not exceed 25 diameters. Special care should be taken when the pillar was subject to transverse strains, where heavy goods of unstable form were piled against them, as a considerable strain might be produced from this cause; and also in the event of blows from rolling goods or other causes. Pillars in juxtaposition to brick walls took the whole load when they were strong enough to bear it; but masonry served to stiffen the pillar if secured to it; and if the wall was built in cement, and of considerable thickness in comparison to the iron pillars, they then possibly might assist each other. In cases where the brickwork was liable to be compressed, and the pillar unequal to its load, then obviously nearly the whole weight must be discharged on the pillar: but care must be taken, as possibly intense compression might take place at the base of the pillar. The basis should be as level as possible. Short columns under crushing force were deformed by pyramid wedges forming at the ends and forcing out wedges at the sides; this was also seen in the crushing of stone and other solid materials. For various forms and sections of pillars, and also of different lengths, the strength of the material would vary considerably under the diverse conditions in which it was placed. For small proportions of length to diameter, cast iron was the strongest material, but its strength diminished, as the proportion of length to diameter increased, faster than wrought iron; and, in comparison of solid square or wrought iron pillars with solid round cast iron pillars beyond twenty-six and a half diameters, wrought iron was stronger. For ordinary work no cast iron columns should exceed twenty-seven diameters. The elasticity of cast iron was twice as great as that of wrought iron. The strength of girders to resist resilience was proportional to the weight of the beam, irrespective of the length, so that a beam twice the weight or twice the length would take twice the load to produce the same deflection. Rolled girders were only economical up to a given size and weight.

PATENT BOTTLE.

Mr. Benjamin C. Odell, of Kingston, N. Y., is the inventor of the novel style of bottle represented in the annexed illustration. The object is to separate, within the same bottle, two kinds of liquid, which can be separately removed, and this is effected by arranging a partition to form two compartments, each of which has its own discharge or spout. It is a handy device for invalids traveling, as medicine might be carried in the smaller division and water in the larger, while a cup, similar to the kind generally accompanying "pocket pistols," might be fitted over the bottom. Any number of partitions may be placed in the bottle, with a corresponding number of spouts. Thus arranged, it might prove valuable to physicians, by affording them the means of carrying quantities of several remedies in a single pocket receptacle.



THE maximum cost of transporting railway freight, last year, between New York and Chicago, was 7 mills per tun per mile. The total cost of moving freight by canal (horse power being used for towage) is 5 mills per tun per mile.

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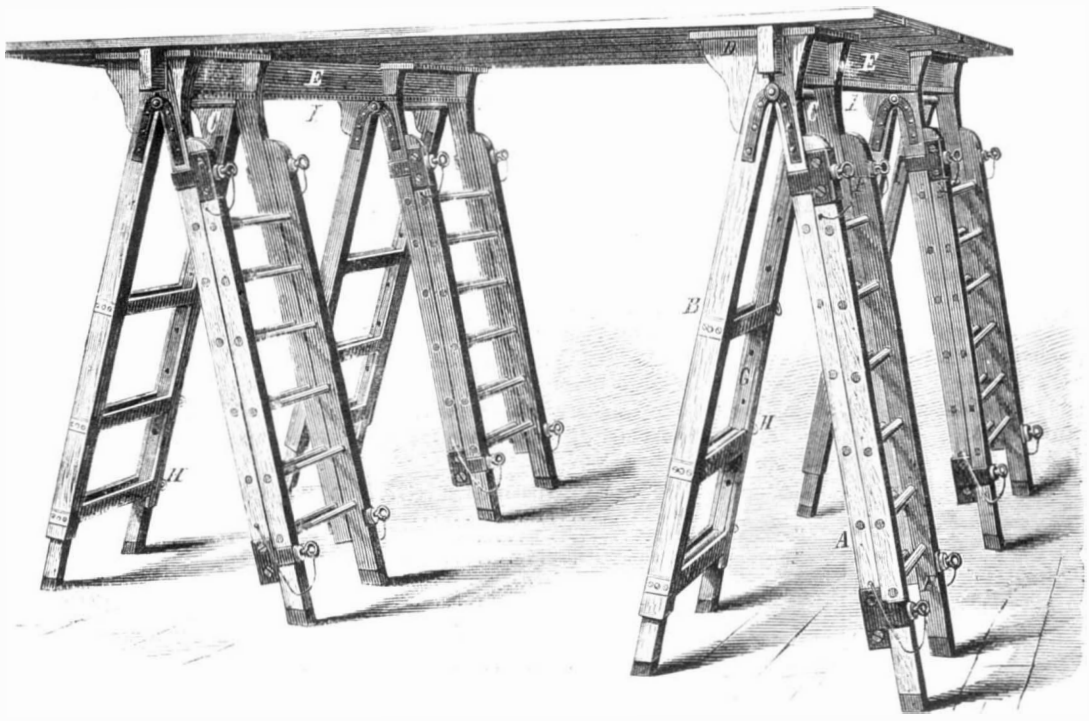
IMPROVED ADJUSTABLE SCAFFOLD.

Painters and other mechanics, who have frequent occasion to use scaffolding in performing their work are, in the invention represented in the annexed engraving, provided with an adjustable extension truss which, according to the inventor, may be applied with equal facility to various purposes. It serves as a truss for scaffolding, a common ladder, platform, and step ladder, and, from its simple construction, may be built quite cheaply. It may be compactly folded, and thus readily moved from place to place.

The two parts, A and B, of the extension truss are hinged together near the top by means of side plates, cross rod, C, and nut, as shown, so as to fold together or to be detachable from each other. The tops of parts A and B are united by lateral boards, D, one of which is hinged so as to fit, when necessary, over the recess which holds the vertical cross piece, E, and which is lined with metal plates. Both parts may be extended to and adjusted at different hights, the front portion by sliding pieces, F, guided by suitable plates, I, one set secured to A, and embracing F, and the other arranged in the opposite manner. Holes in the sliding pieces and pins serve to lock the former in any desired position. The top slide plates limit the upward motion of the sliding pieces, F, the lower ends of which project beyond the parts, A, and are provided with metallic sockets, produced with the angles of inclination of the truss to the ground. Both portions are connected by rounds in such a manner that they offer, in any position, a double support to the foot.



DILLON'S ADJUSTABLE SCAFFOLD.

The rear part, B, is extended by means of slides, G, which move in guide recesses. Lateral pieces stiffen the fixed portion, while steps or rods serve the same purpose for the slides. The connection of the two parts, B and G, is made by holes in both washer plates at the outer sides of part, B, and cross rods, H, with screw ends and heads, by which the whole is firmly retained in any position corresponding to that of the part, A. The slides, G, also terminate underneath in suitable shoes or sockets.

The platform may be constructed as represented in our illustration, or the cross pieces, E, may be removed and longitudinal timbers laid between the opposite trusses under the lateral boards, D, and above those marked I. Heavy bolts passing through all secure the beams in place.

The inventor states that, when the device is folded up, the boards connecting the trusses may be secured between the steps of the front part, A, serving thereby as a support for paint pots and other implements. In similar manner either half may be used as a suspended platform for painters in painting the outside of houses, while the detached front part may be applied as an extension ladder.

We are informed that a 4 feet 10 inch truss, as shown in the engraving, makes a scaffold that will reach to a ceiling of 14 feet 6 inches in hight. It also forms a step ladder of from 4 feet 10 inches to 8 feet, and of five distinct sizes.

The device may be used upon stairs as easily as on a level floor, by extending the front part two steps, or a sufficient distance to accommodate the rise. It has no braces, is self-bracing on top, and can never, it is claimed, spread or give way.

Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars regarding sale of State rights, etc., address the inventor, Mr. John Dillon, 405 Fourth avenue, New York city.

A NEW MAGNETO-ELECTRICAL INSTRUMENT.

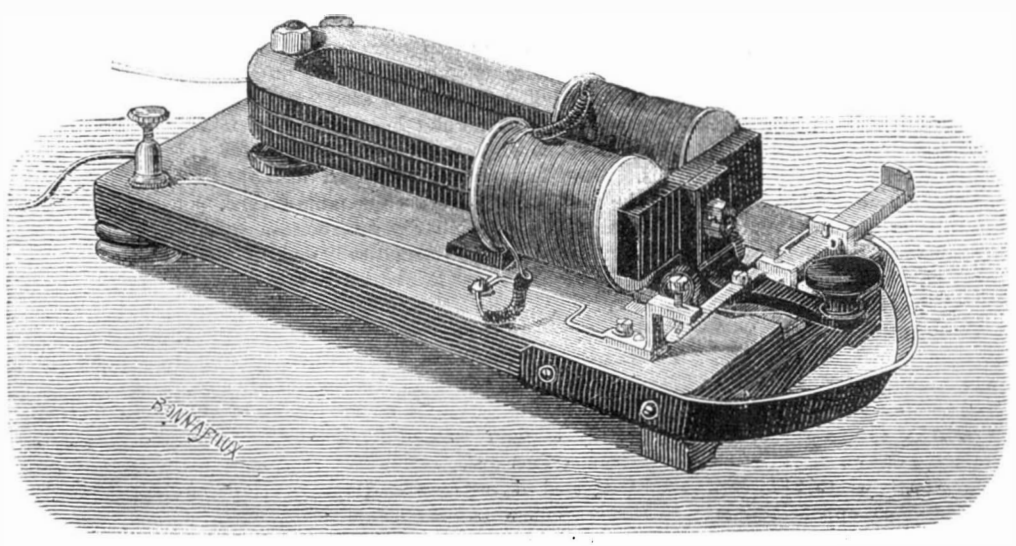
A novel form of magneto-electric battery, adapted for use as an exploder, is represented in the annexed engraving, which we extract from the pages of *La Nature*. It consists simply of a horseshoe magnet, around the arms of which are wound coils of insulated wire. To the poles is applied an armature of soft iron. The apparatus is a reproduction of a similar device used by Faraday in his experiments to show that, when the armature was suddenly removed from the poles, a current is almost instantly established in the coils, while, on replacing the iron, another current was engendered similar to the first, but in the contrary direction.

In order to use the current thus obtained, in place of that of an ordinary battery for exploding charges, a high tension is necessary, and this is obtained by a simple and ingenious attachment. The key which moves the armature carries a small spring (shown on the left in the engraving) which touches a screw. When the armature is removed from the magnet this contact is broken, but not instantaneously, as the parts touch until two thirds of the motion is completed. One of the conducting wires is connected with the lever of the armature, the other with the screw; consequently the current caused by the sudden break is kept within the apparatus during two thirds of the time of its production. This arrangement, which, at first sight, would appear designed to cause the loss of the effect of the greater portion of the current, really increases the tension, because the current which is delivered by the machine is no longer the magneto-electric induced current, but the extra current of the latter—in other words, a second induced current, which is produced at the moment of the rupture of the local circuit of the magneto-electric current. In round numbers, the attachment augments the current in the proportion of 1 to 5, and gives a spark which will explode ordinary hunting powder placed loosely between metal points.

This device is undoubtedly one of the simplest yet devised, for its purpose, as well as one of the easiest constructed. Its energy may be increased by using more powerful magnets, the Jamin, for example.

We should imagine that it might be advantageously substituted for the battery in short telegraph circuits; and in fact, it has been used for that purpose in the Vienna Exposition. The key of the instrument was manipulated exactly as that of the ordinary Morse machine, producing a series of currents alternately positive and negative, which operated a Morse receiver having a polarized armature.

For military telegraphs, the device would be very useful on account of its light weight, simplicity, and absence of battery. Another application which suggests itself is for counting either the revolutions of an engine or of a wheel in a vehicle, and transmitting knowledge of the same to any desired point. An eccentric might be arranged on the shaft the revolutions of which it is desired to know, so that at each turn the contact of the armature with the poles might be ruptured, and a current sent to a suitable receiver or counting apparatus, easily devised. Many other problems, it appears, may be solved by this machine, and inventors will find in its further applications an excellent field for the exercise of their ingenuity.



A NEW MAGNETO-ELECTRICAL INSTRUMENT.

C. G. V. P. says: "The reason we have so many false theories about ventilation is this: We have heard or read that carbonic acid is heavier than the pure air, and consequently must sink to the bottom, and should be discharged at the floor; but we forget that carbonic acid coming from our lungs has a much higher temperature than the surrounding atmosphere, consequently it rises. Make the discharge, therefore, in the ceiling or the chimney, and you are rid of it."

The Propagating House.

Our readers will perhaps say: "This subject has no interest for us, inasmuch as we do not possess such a luxury, and indeed consider such a structure entirely out of our reach." In this instance, however, if such have been your thoughts, readers, you have prejudged the case, for we intend showing how a splendid propagating house may be had at no additional cost to those who possess a small stove or vinery. We have seen this plan adopted in the gardens of a peer of the realm, and found that it answered admirably, and is worthy the notice of all who delight in their gardens, and have a love of plants, for by its use a good supply of young plants may be maintained for the decoration of the dwelling rooms and the dinner table, while no end of plants can be struck in spring for flower garden purposes. In the first place, then, readers, we will imagine you have a small vinery heated with hot water; that you have now, or will soon, start the vines, and will, therefore, have a nice gentle heat at command. Now our system does not consist in bringing in any large frames or hand lights to take up the limited space, because, if you are economical and practical, you will have brought in a considerable number of strawberry plants to produce some luscious early fruit, one or two pot vines to help out the crop from the roof, a few pot roses, some spireas, lilacs, and other fragrant shrubs to delight the olfactory nerves; but it is simply to have some small narrow frames made to fit the troughs on the pipes, these narrow frames to be fitted with a glass top; the troughs in question, being kept filled with water, produce a splendid moist bottom heat, which is one of the great desiderata in the propagation of most stove plants and all soft-wooded things; the frames need only to be a few inches high; they should have some drainage material placed in the bottom, and the remainder may be sand only, or what we prefer for striking the majority of cuttings in, namely, the refuse from cocoa nut fiber. In this material, and in such situations, cuttings of verbenas, coleus, geraniums, heliotropes, fuchsias, and any such kind of plants, may be rooted in a few days, while, as a matter of course, harder wooded plants will take a little longer. This is not a theory, readers, but has been reduced successfully to practice for many years, and those who would do more in the embellishment of their gardens, but for the want of a propagation house, may, with a few such little frames, produce any amount of plants in the spring months for summer use, and we cannot too strongly urge them to give it a trial.—*Land and Water.*

Floats for Ships' Boats.

The Marine Department of the London Board of Trade have been making experiments with the boats of coasters, and find that any old boat can be converted into an efficient lifeboat by using air casings outside. The Marine Department have, for this purpose, used air cylinders, which they have specially designed, fastened outside the boat by a netting; so that the boat can be used for an ordinary boat as long as wanted, and converted into a lifeboat when occasion requires it. The material used for these cylinders, and approved by the Marine Department, is a combination known as Clarkson's. It consists of a layer of cork about a quarter of an inch thick between two layers of strong canvas. One cubic foot of air space in these cylinders will support about 60 lbs. The cylinders of this material are the cheapest, most efficient, and most durable means yet invented for converting an old boat into a lifeboat. Mr. Clarkson has made the experimental cylinders on models furnished to him by the Marine Department, and is, we believe, prepared to supply any number demanded. Air cases to place inside lifeboats, also made of this material, have been supplied to some of the mail steamers, and are much preferred by the Marine Department to cases of copper, iron, zinc, or wood, as they are practically indestructible, are not affected by heat, and are very light.—*Nautical Magazine.*

- NOTHING can convey a more impressive idea of the power of water as a general agent than the wonderful cañons of Mexico, Texas, and the Rocky Mountains, where the torrents may be seen rushing along, through the incision it has cut for itself in the hard rock, at a depth of several thousand feet between perpendicular walls. The greatest of these cañons, that of Colorado, is 298 miles in length, and its sides rise perpendicularly to a hight of 5,000 or 6,000 feet.

DR. M. WYMAN, who made the autopsy of Professor Agassiz, states that the latter's brain weighed 53·4 ounces.

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Correspondence.

Harmony of the Planetary System.

To the Editor of the Scientific American:

Allow me to remark that the so-called new harmonic law existing between the planetary distances and motions, published "to the world" in your issue of March 21, 1874, page 131, by Mr. Alfred Luther, as superior to Kepler's third law, is only a deduction from the same, as is easily proved by expressing it in a formula.

The rule given by Mr. A. Luther is this: "The square root of the quotient arising from dividing the distance of any exterior planet by the distance of any interior planet, multiplied by the velocity of the exterior planet, shall equal the velocity of the interior planet." Calling the distances D and d and the velocities V and v, then the formula corresponding to the rule is this: $\sqrt{D \div d} \times V = v$. From this we deduce successively

$$\sqrt{\frac{D}{d}} = \frac{v}{V}, \text{ or, by squaring, } \frac{D}{d} = \frac{v^2}{V^2},$$

giving the proportion $D : d :: v^2 : V^2$, which means that the distances are inversely proportional to the squares of the velocities.

According to Kepler's third law we have (calling the times of revolution R and r) $R^2 : r^2 :: D^3 : d^3$, or, by extracting the square root, $R : r :: \sqrt{D^3} : \sqrt{d^3}$ ..... (1).

As the time of revolution is, for equal velocities, in the ratio of the distances, and for equal distances in the inverse ratio of the velocities, we have $R : r :: D \div V : d \div v$..... 2)

By combining the proportions (1) and (2), we obtain

$D \div V : d \div v :: \sqrt{D^3} : \sqrt{d^3}$. Multiply with

$V : v :: V : v$; we obtain $D : d :: V\sqrt{D^3} : v\sqrt{d^3}$, or

$$D : d :: \sqrt{V^2 D^3} : \sqrt{v^2 d^3}.$$

Squaring this equation, to eliminate the root sign, we have: $D^2 : d^2 :: V^2 D^3 : v^2 d^3$, a deduction from Kepler's third law, in which velocity is substituted for time of revolution. Dividing this proportion by $D^2 : d^2 :: D^2 : d^2$, we have $1 : 1 :: V^2 D : v^2 d$. Hence $V^2 D = v^2 d$, or $D : d :: v^2 : V^2$, showing that the statement that the distances are inversely proportional to the squares of the velocities is nothing but one of the disguises in which it is possible to clothe Kepler's third law. From this proportion, it follows directly that:

$$V^2 = \frac{D \times V^2}{d} \text{ and } V = \sqrt{\frac{D}{d}} \times V^2,$$

which is the identical formula expressing the rule given by Mr. A. Luther.

P. H. VANDER WEYDE, M.D.

New York city.

Calming the Sea by Means of Oil.

To the Editor of the Scientific American:

I have a suggestion to make which may be of much importance to navigation in steamers. Although I have never tried my plan on so large a scale as is now proposed, I have tried it successfully on a small scale. It is simply to use oil in subduing or mitigating the force of the breaking wave. Some seventeen years ago, I fitted out a small iron steamer to go to the La Plata. She was of light construction and shallow draft of water, and was temporarily rigged as a three masted schooner. Her paddle wheels, *minus* one half the buckets, were shipped and lashed; the deck or covering of the guards was omitted, so that nothing save the iron arms of the wheels and the supports of the guards, also of iron, remained to interfere with the sailing qualities of the vessel. She left Boston about January 12, and arrived in the La Plata in sixty days, during which time the floats were occasionally shipped in full to carry her over calm spots. She had a keel put on with tap bolts, so contrived as to be taken off on arrival without docking, if required. Considering the stormy season of the year, and ignoring the fact that her officers and crew might more reasonably expect to be hanged rather than drowned, I made every provision for her safety; and among these, I lashed a half barrel of oil on the tafril rail and one on each side, and ordered the captain to allow a little to escape from the first in scudding, and a little from the one on the weather side in laying to. She had some rough weather on the coast and in the Gulf, and this afforded ample opportunity to test the calming effect of oil poured upon the waters. It answered the purpose admirably, no sea ever breaking on board.

Now let me suppose a large cask of oil, stowed securely some ten feet, more or less, above the water line, on deck or under deck in an ocean steamer; attach to this a suitable hose of vulcanized rubber, with a small orifice, perhaps half an inch, and let this be fitted to rig out by means of a spar something like the bowsprit of a cutter; have it fitted with guys and topping lift, and shove it out ahead thirty to fifty feet; to the hose attach a cock, to be under command of the officer of the deck, and let him discharge oil on the water whenever he sees a wave coming. Steamers going head to a heavy sea, as is well understood, must reduce their speed materially and thus consume much time, or run the risk of getting heavy seas on board. Keen competition and the demand for rapid runs cause the risk to be frequently incurred, and we hear of serious disasters every day. While I do not imagine that pouring oil on the troubled waters would keep absolutely dry the forecastle of a powerful steamer going head to a gale, I do religiously believe that it would do much to keep down the crest of a breaking wave, and that it would enable steamers to go directly against the sea, when, without the oil, they might be compelled to take the sea "on the shoulder." No one ever heard of a whaler with blubber about decks being boarded by a sea.

It would be certainly effective when the steamer is obliged to slow down to three or four knots, and also when laying to for repairs or cooling off bearings.

For light ships riding in exposed places, such as Nantucket South Shoal, Sandy Hook, and many other localities, the oil would be very satisfactory.

The only question in my mind is whether at high speed (for a gale and large sea), say nine or ten knots, the oil could be dropped far enough ahead to have the desired effect. The experiment can be tried very easily and at no great cost, by squirting out oil by a force pump, and if it should prove successful a more economical plan can be adopted. The idea will, by some who have never thrown grease over in scudding off the Cape, be deemed somewhat Quixotic, and it may be derided by some old salts who think they have nothing to learn. Let these go down to the Jersey coast and run a lifeboat off or on through a sharp surf, and they, being supplied with a bucket of oil, can be convinced of its efficacy in keeping the sea from breaking.

Milton, Mass. R. B. FORBES.

The Greatest Mine in the World—Ten Millions and a Half in One Year.

The Belcher gold and silver mine in the Comstock lode, Nevada, is without doubt the greatest bullion-producing mine in the world. It has produced in the last two and a half years the immense sum of $16,772,965. In 1873 it produced $10,779,171 and paid out as dividends $6,760,000 during the year, a large surplus being carried forward. By adding the dividends under the old organization and deducting the assessments levied, we have the following results up to March, 1874:

Dividends, June 1864 to May 1865 inclusive.....	$ 421,200
" to 1872.....	2,184,000
" " 1873.....	6,670,000
" in Jan. and Feb. 1874.....	1,040,000
Total dividends.....	$10,405,200
Assessments Dec. 1865 to April 1871.....	660,400
Stockholders' profits.....	$ 9,744,800

The cost of crushing the ore was $12.10, and the cost of mining was $8.51 per tun; total $20.61. The number of tuns worked in 1873 was 154,664; the total receipts of bullion in 1873 were $10,779,171.07; the average yield per tun in 1873 was $69.69.

The bullion statement is as follows, from the stamped value of bullion as per assay certificates: Value in gold, $5,725,247.50; value in silver, $5,009,520.51; assay grains, $44,403.06; total, $10,779,171.07. Number of ounces of refined bullion, 4,173,535·74-100. Average fineness of gold, 66½ thousandths; average fineness in silver, 0·929 thousandths. Value per ounce in gold, $1.37 19-100; value per ounce in silver, $1.20 2-100. Value of bullion per ounce, $2.57 21-100; average value per tun in gold, $37.16; average value in silver, $32.53; total value per tun, 69.69. This statement will appear strange to those who suppose the Comstock lode produces nothing but silver, as it shows that in this, the greatest producing line on the lode, the gold predominated.

This mine has no parallel in the world, the Crown Point, adjoining it, being the only one approaching it in richness. The mine produced in two and a half years nearly seventeen millions of dollars, and since its opening has paid nearly ten millions of dollars as dividends above all assessments. The success of this and the Crown Point has encouraged mine owners on the whole Comstock to pursue developments at greater depths. The circumstances connected with the development of the Belcher into a first class mine furnish an example for other mines in similar circumstances. After their ore gave out, they worked systematically and uninterruptedly until they developed the largest ledge ever opened in any mine in the world.—*Scientific and Mining Press.*

Pacific Ocean Deep Sea Soundings.

At a recent meeting of the California Academy of Sciences, Professor Davidson announced some of the results of the soundings made by Captain George T. Belknap, of the United States steamer Tuscarora, during last year, with reference to the projected laying of a telegraphic cable from this coast to Japan. This work had accomplished a remarkable development of the depths of the Pacific Ocean, which had no parallel in the plateaus of the Atlantic. The Tuscarora first started in her line of soundings from the entrance to the Straits of Fuca, across that portion of the North Pacific designated as the Gulf of Alaska, toward the Asiatic coast. After leaving the entrance to the straits, the bottom slopes gradually to a depth of 100 fathoms, and then a sudden descent occurs, which reaches a depth of 1,400 fathoms, at a distance of 150 miles from the coast. The temperature of the water at the greatest depth on this line of survey was 34 degrees.

Commander Belknap then returned, prosecuting off and on soundings all along the coast to the entrance of San Francisco Bay. This work determined the fact that the sudden descent at the bottom of the Pacific to a great depth is continuous down the entire coast, varying from twenty to seventy miles out. In the latitude of San Francisco Bay, the great bench is reached a short distance off the Farallones, where the bottom suddenly descends to a depth of two miles. Off Cape Foulweather, the bottom descends precipitately from 400 fathoms to a depth of 1,500 fathoms, and then the plateau continues westward for hundreds of miles, and comparatively as level as a billiard table. Off Cape Mendocino, where shoals have been erroneously supposed to exist, from the seaward jutting of the mountains, a depth of 2,200 fathoms is reached eighty miles from the shore. Thirty miles off the Golden Gate, the bottom is reached at 100 fathoms; at 55 miles, it has descended to 1,700 fathoms; and 100 miles out, the enormous depth of 2,548 fathoms has been measured without reaching bottom.

Improved Shifting Engine.

A new improvement on the shifting engines on the Pennsylvania Railroad has been introduced, which is in great favor with those running them, and fully meets the expectations of the company, at whose shops in Altoona they were constructed. The ordinary tankless "dinkey" has to be supplied three times a day with coal and water, while enough fuel can be stored in the tank of the improved engine to last three days, and water enough to supply the necessary steam for a day and a half. The engine is also supplied with the steam bell, an invention perfected at the shops of the Pennsylvania Railroad Company. By pulling an apparatus in the cab by the engineer, the bell rings and continues to do so until he pushes it back to its natural position. The tank of the tender connected with the engine has a capacity of 1,200 gallons of water and about three tuns of coal. The engineer is also enabled from his position to see the brakeman while coupling, which has a tendency to diminish accidents.—*American Railroad Journal.*

Tunnels.

The completion of the Hoosac tunnel and the rapid progress of the Sutro have caused the miners both in the East and in the West to look with interest upon what has been and is projected in connection with tunnel driving. It is in Germany, says the *Mining Journal*, that the great tunnels have been constructed, and these have been made exclusively for mining. There is the great tunnel at Freiberg, twenty-four miles long; the Ernst-August and the Georg at Clausthal, thirteen and a half and ten and three quarters miles respectively; the Joseph II. at Schemnitz, nine and a quarter miles; the Rotschonberg at Freiberg, eight miles; the Mont Cenis, seven and a half miles, which about completes the European list. In the United States we have the Hoosac, in Massachusetts, five miles long; the Sutro, in Nevada, for opening up the celebrated Comstock lode: this tunnel, although only four miles long, will, with its ramifications to the various mines of the district, prove one of the most important in America: the Sierra Madre tunnel at Black Hawk, commenced during the present year, and which will be twelve miles long, as well as San Carlos and Union Pacific tunnels, which are under two and a half miles. The Ernst-August tunnel was driven at the rate of a mile per annum, and it will be interesting to notice how long it will take the Americans, with all the approved appliances at present at command, to complete the nearly similar Sierra Madre tunnel.

The New Geyser Basin.

That a new and most important geyser basin has been discovered in Eastern Montana, seems now unquestionable. It was visited last fall by the well known mountaineers Jack Baronett, John Dunn and John Allen. It is represented as much more extensive than any of the already explored basins, and to contain geysers of much greater force and volume than any yet described by tourists. One of these newly discovered geysers is estimated to throw a volume of water forty feet in diameter over five hundred feet high, and to continue in eruption from ten to fifteen minutes. It is also reported that in this newly discovered basin there are "mud volcanoes" far surpassing in volume and eruptive force those on the Upper Yellowstone. This unexplored spot of the most wonderful of all our natural wonders is about twenty-five miles southeast of the summit of Mount Washburn, from which point the greater geysers, when in action, when the air is clear, are visible to the naked eye.—*Avant Courier.*

IN a recent article upon "Swindling Patent Sellers," allusion was made to a concern styled the Western Michigan Patent Agency, formerly of Albion, Mich. Messrs. G. L. Jocelyn & Co., of Grand Rapids, proprietors of an establishment at that place entitled "Western Michigan Patent and General Collection Agency," write to us, requesting that our readers may not confound their enterprize with any of the swindling concerns intended to be exposed by our article. The similarity in name, they fear, may lead to misapprehension, and they wish it understood that theirs is an honest and reliable concern, in proof of which they send us certificates from leading citizens of Grand Rapids. These documents speak well of the personal and business merits of the Messrs. Jocelyn, and indicate that they are engaged in a useful line of operations. Individuals who can so fully command the confidence of their fellow citizens as do these gentlemen have, we think, little reason to fear that the public will couple them with the professional cheats against whom our former article was especially directed.

OBJECT FOR THE POLARISCOPE.—Rev. William Law informs the *English Mechanic* that the following are two of the finest subjects for the polariscope which animal tissues can supply: Thin slices of the upper part of a pig's claw, cut transversely, and of the paw of the polar bear. Both are indescribably beautiful. They are, when cut, dropped into strong spirits of turpentine and mounted in Canada balsam. The bristles of the hedgehog also form very beautiful objects for the polariscope.

THE OPTIC NERVE.—By a microscope examination of the retina and optic nerve and the brain, M. Bauer found them to consist of globules of $\frac{1}{2800}$ to $\frac{1}{4000}$ of an inch in diameter, united by a transparent viscid and coagulable gelatinous fluid.—*E. Lovett.*

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Loiseau's Artificial Fuel Manufacture.

Mr. Emile T. Loiseau, of Mauch Chunk, Pa., the inventor of a very complete and, we believe, efficient process for the manufacture of artificial fuel out of coal waste (which, it will be remembered, was not long ago illustrated and described in these columns), has recently obtained five patents through this office which cover the essential points of his improved machinery and system.

Mr. Loiseau, we also notice, has lately delivered an excellent and able lecture on the subject of "Artificial Fuel" before the Franklin Institute in Philadelphia, which has been printed in the Journal of that association. The subject has created considerable interest among those practical coal miners and owners of mines who realize the important problem of utilizing the immense quantities of coal dust which now cumber the ground in the vicinity of our mines.

The first of the patents above referred to relates to the entire process of manipulating coal waste to convert it into a convenient fuel form by first mixing it with clay, then molding into blocks, drying, and finally applying a waterproof coating. Mixing and molding separately is the subject of a second patent, which covers machinery used to combine the coal dust with clay and lime water in suitable proportions, introducing it into a pug mill in a plastic state, and then delivering it to compressing cylinders in a broad sheet. Within the cylinders, it is divided and pressed into blocks or lumps convenient for use and passed to an apron to be dried and further prepared for use. The mixing apparatus, consisting of a tub in which are a number of arms and shafts constituting a movable spider in combination with a stationary one, is made the subject of a third patent. The various arms in this machine are so arranged that they revolve without interfering with each other, while every portion of the material is submitted to their action. The fourth patent refers to the drying oven in which are a number of belts arranged one above the other, and connected by a system of gearing to carry the material back and forth and finally deliver it near the bottom. The belts are strengthened by ropes which carry a series of metal balls which engage in recesses in drums, serving as cogs to propel the belts.

The last patent covers the waterproofing device, by means of which the fuel is coated with a material which renders it impervious to moisture. The machine has an endless belt which dips in a tank, and is guided therein by balls entering suitably inclined grooves. The lumps delivered on the apron are carried through the liquid and are thus covered with a waterproof covering which dries upon exposure to the air.

Mr. Loiseau has also obtained foreign patents on his inventions, and parties interested in mines at home or abroad are invited by the inventor to examine into his system of utilizing what is now a waste substance.

The experimental trials, conducted some time ago to test the heating powers of the product, indicated a very fair rate of power, and considerable cohesion. These qualities were fully tested at the exhibition of the American Institute, and with very favorable results. As to the important question of cost, the inventor states that the article can be manufactured for about one dollar per tun.

The Early Education of Children.

In a lecture, Professor Walter H. Smith, of Boston, Mass., said that the want of accuracy in children should be no source of sorrow. He considered it more desirable that they should be dull and stupid at first, that their process of education might be more gradual and thorough. A rapid development should be checked rather than encouraged. One plan of instruction which was followed with success was a course of study of lines and forms, requiring the pupils to draw from description and dictation. Simple forms and objects should be selected first; and when the pupils are sufficiently advanced, more difficult and complex forms could be substituted, each step being so gradual that no perceptible improvement is shown at the time, but which, when looked upon afterward, will denote rapid progress. This plan, he said, insured perfect attention on the part of the pupil, and developed an absorbing interest in the work.

New Process for Iron Making.

F. W. Gerhard has completed a new process which is attracting considerable notice. The invention consists in the manufacture of puddled iron direct from the ore, the use of the blast furnace being dispensed with. Instead of using pig iron, Gerhard uses a compound which he calls "iron coke," and which consists of a mixture of ore (or any substance containing iron), the necessary fluxes, and the equivalent of carbon. A lump of this compound is put into the furnace, and by the single process known to the puddler as "balling," a "heat" may be obtained in considerably less time and with considerably less labor than under the old method; the process of "melting" and "boiling" being entirely dispensed with. The most important feature of the invention is the great saving which it effects in fuel. Bell estimates that 5½ tuns of coal are required to produce a single tun of bar iron, but Bennett Aitkins puts the amount at six tuns seven hundredweight. Taking the average at six tuns, it may be reckoned that two tuns are consumed in the blast furnace, and the remaining four tuns in the finished iron works. The protoxide of iron containing 77·78 per cent requires 21·43 of carbon. The magnetic oxide containing 72·41 per cent requires 32·17 of carbon. Admitting that the three descriptions of iron ores were employed in the making of cast iron, by the new process, then 30 lbs. of carbon would suffice to produce 100 lbs. of cast iron; or a tun of iron, weighing 2,400 lbs., would require 750 lbs. carbon, a saving of 3,760 lbs. carbon as compared with the ordinary method. It is obvious that when heavy pieces of solid pig iron are placed in a puddling furnace to be melted, the greater portion of heat is wasted, and after it is liquefied a much longer time is required to eliminate the carbon which it contains and other extraneous elements of which it is composed, with a continuation of an immense waste of fuel. On the contrary, when the "iron coke" is thrown into the heated furnace, the carbon which it contains immediately acts upon the oxygen contained in the ore. Even the Barrow hematite—one of the most refractory of ores—is ready for "balling" with a much less expenditure, of time, labor, and fuel, than by the old process. These statements have been abundantly verified by experiments made in the presence of practical ironmasters and ironworkers, who speak very highly of the merits and importance of the invention.

Launch of the Cable Ship Faraday.

The new cable steamship Faraday, which has been built by Messrs. C. Mitchell & Co., Newcastle, England, for the Messrs. Siemens Brothers, for the purpose of laying their Atlantic cable, was launched on the 17th of February last.

The vessel has been built to the order of Messrs. Siemens Brothers, London, for the purpose of laying their Atlantic cables, and in every requisite the ship is certainly one of the most perfect of its kind. The steamer is 360 feet long, 52 feet beam and 36 feet deep. Her gross register tunnage is about 5,000, and her dead carrying weight about 6,000 tuns. The iron hull, built under the inspection of Lloyds' agents, will be accorded the highest certificate of classification. From her peculiar structure, the vessel receives enormous strength, in addition to the usual requirements of Lloyds' rules. Supporting the sides of the vessel are three enormous cable tanks, constructed of plate iron, and forming a series of double arches. These are united together, and attached to the general fabric of the vessel by five iron decks. For the comfort and convenience of those on board, the upper and main decks are supplemented by the usual decks of wood. The Faraday is double bottomed, and in the space below the two bottoms is a net work of iron girders for carrying the cable tanks, and these give also a longitudinal strength to that portion of the hull. Water ballast is also carried in this space, by which the ship may be trimmed as the paying out of the cable is carried on. This arrangement has likewise the advantage of dispensing with cargo or other dead weight beyond fuel. For the purpose of filling and emptying single compartments of the double bottom, or for flooding any one of the cable tanks, a complete and well devised system of valves, cocks, pipes, and auxiliary engine power has been introduced; and the system, which is worked from the engine room, is under the control of the engineer. The bow and stern of the vessel are of the same form, and in this respect she is unlike other vessels in outward appearance. Rudders are provided at each end, and she can thus be navigated ahead or astern, as may be desired when paying out or picking up a cable. Each rudder, to provide against accident, is supplied with strong screw steering gear, worked in the usual manner by manual power, and the steering is accomplished by means of a steam engine placed amidships. Harfield's steam windlass works the anchors and cable chains, and steam apparatus, placed in various positions along the deck, performs all the heavy labor about the vessel. The rigging is after the most approved manner of ocean steamers, and accommodation is provided of the most complete nature, for the large staff of officers, electricians and crew, numbering about 150 persons. In addition to the multifarious appliances of a cable ship, the vessel will be fitted up with all the cabins and appliances of a large passenger steamer, and will be propelled by machinery of the compound, surface-condensing principle, which has been constructed by Messrs. T. Clark & Co., of Newcastle. To obtain increased steering or manœuvring power—an important condition in cable laying—the steamer will be provided with two propellers, commonly termed "twin screws," which will be worked by two separate sets of engines, placed vertically over the shaft, each with two cylinders, one at high and the other at low pressure. By this means great regularity of motion will be obtained, and by a high degree of expansion, in working the system, fuel will be greatly economized, to an extent that would have been considered impracticable a few years ago. The deck machinery for the paying out of the cable is being manufactured by the Vulcan Foundery Company, who are experienced in this branch of work. It is needless to say that the Faraday has been called after the great English chemist and natural philosopher of that name.

English and American Railways.

The London *Railway News* has some interesting comparisons of English and American railway returns, and in the matter of rolling stock and train earnings is surprised to find the American roads more economically run than the English. Taking four roads in each country, aggregating about 4,000 miles, it is found that the American road has only 0·33 of a locomotive and 6·72 freight cars per mile, while the English has 0·93 of a locomotive and 28·83 cars. The New York Central, with a heavier traffic than the London and Northwestern, has half the locomotive per mile. The English refuse to believe that the superior size and strength of American locomotives account fully for this difference. The earnings, for instance, of an American locomotive are 70 per cent more than those of an English, and the entire rolling stock, which in England barely pays for itself in a year, in this country pays for itself and 65 per cent more. The *News* also discovers that, while passenger fares are 30 per cent lower than in England, the earnings per train here are 4 per cent more, and on freight trains 15 per cent more, than on the English roads.

Pipe Way Transportation.

Pipe way transportation is coming into favor in the oil regions of Pennsylvania, to carry petroleum from the wells to stations on the railway. The longest pipe way is 15 miles, overcoming 400 feet of elevation by steam pressure at the entrance to the tube. This system of transportation is so independent of weather and bad roads, and so preventive of leakage, and gives such thorough satisfaction without any drawbacks, that public attention is directed to many other practical applications of the same system.

Twenty-five years ago, on the national road between Cumberland and the bituminous coal field beyond, we saw a small rivulet turned to similar account in the cheap transportation of coal. A zigzag, ½ inch board flume followed the tortuous course of the petty stream and carried 6 inches depth of water and 12 inches surface. A dam collected water enough to make two runs of coal a day. Each run bore in its current 30 tuns of coal, fed from a chute with a rake. The distance is under 5 miles; the fall was at least 20 feet to the mile. The coal floated along with ease, carrying with it chunks of slate and conglomerate rock. There were chutes for its reception on the turnpike. These had screens, over which the coal passed, being perfectly cleansed and polished before entering. All day long wagons were self-loading under these chutes. The cost of transportation over the water way was merely nominal. It was an easy step for invention to suggest pipe ways for similar transportation of fluids, and for mails and packages, by pressure of condensed air, as now used in London.

It is not generally known that, in France, the pipe way system has been used for ten years past in transporting beet juice from the field to the sugaries. The sugaries at Cambria work up annually 246,000 tuns of beets; they are supplied with beet juice through 62 miles of pipe, now being extended to 100 miles, in many ramifications.

At points central to cultivation, works are erected for rasping beets and expressing juice. Milk of lime is immediately added to prevent decomposition; and after inspection and measurement, the saccharine stream is turned into the pipe way and delivered at the terminal sugaries, the long contact with lime and the thorough agitation purifying the juice more perfectly than usual. It is estimated that, during 1874, there will be a total length of such pipe ways of 560 miles, doing service between the scattered beet fields and the condensed sugar works of France.

The pipes are placed two feet eight inches below the surface, and steam engines compress the air as desired. All degrees of elevation are thus surmounted. The juice has a gravity of one degree Baumé on entering, and the same when discharged.

This pipe way system so economizes sugar making that it wonderfully multiplies the sugaries. No investment excels that concerned in this production. Farmers find it far better than other crops. Pipe way stocks are in high favor, and sugaries pay best of all.

If new industries are needful to the future progress of California, here is one that should be considered. It offers a wide field for expansion, without risk of oversupplies; and if the right soil be selected, the crop is sure, and the profits of sugar-making are more than usually reliable.—*Mining and Scientific Press.*

Norwegian Antiquities.

At a recent meeting of the California Academy of Sciences, R. E. C. Stearns read an interesting translation from the reports of the Society for the Preservation of the Norwegian Antiquities. It described the excavation of an ancient vessel, of the Viking period, found in the parish of Tane, Norway. It was the custom of the Vikings to convert one of their vessels into a sarcophagus, on the death of a great warrior. The vessel was conveyed inland, the remains of the hero deposited in the hull, with his armor, weapons, the bones of his war chargers, and the whole covered with earth. These tumuli have been discovered and excavated in various parts of Norway, and the peculiarities of ancient marine architecture exposed for inspection.

Good Work in Canada.

Mr. A. Davis, of Belleville station, on the Grand Trunk Railway of Canada, forwards us a list of twenty-one subscribers, obtained among the 132 workmen under his charge. This is an excellent showing both for our correspondent and his men, as it indicates on his part a desire to benefit those in his employ, by placing within their reach information of practical value in their callings, while the workmen themselves exhibit good sense and intelligence in availing themselves of the advantages offered.

Mr. Davis tells us that more names are yet to come, and adds: "I take much pains in having my men first class." We think, from the fact of his obtaining so many subscribers out of the comparatively small number of men under him, that Mr. Davis supports his claim for the good qualities of his men.

PRESERVATION OF WOODEN LABELS.—The following method of preserving wooden labels that are to be used on trees or in exposed places is recommended: Thoroughly soak the pieces of wood in a strong solution of sulphate of iron; then lay them, after they are dry, in lime water. This causes the formation of sulphate of lime, a very insoluble salt, in the wood. The rapid destruction of the labels by the weather is thus prevented. Bast, matting, twine, and other substances used in tying or covering up trees and plants when treated in the same manner, are similarly preserved. At a recent meeting of a horticultural society in Berlin wooden labels, thus treated, were shown, which had been constantly exposed to the weather during two years without being affected thereby.

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IMPROVED STOVE FOR SMOKE HOUSES.

The invention represented in the annexed engravings is a stove or furnace in which it is proposed to generate smoke by burning twigs or other suitable fuel. The device is to be used in the ordinary smoke house for curing meats, and is so constructed as to produce a large volume of smoke, regulate its production, and insure safety against fire.

The body, which may be made of any suitable material, is provided with perforations on top and also at the sides. Within is the grate, A, shown through the broken-away portion of Fig. 1, and in the sectional view, Fig. 2, which is formed with inclined sides and a horizontal middle portion provided with apertures closed by the damper, B, Fig. 2. By this arrangement, it is claimed, the admission of air to the fuel, and the combustion thereof, can be regulated with great exactness, to suit dry or green wood, or any other cause of variation in the smoke-producing circumstances.

In the upper part of the chamber is placed a partition, C, also having inclined sides through which are a number of perforations. These apertures are governed by suitable dampers, the handle of which is shown at D, Fig. 1, and which regulate somewhat the combustion in the grate below, according to the condition of the wood or the draft.

The device is quite simple and is said to be very efficient in operation. It is covered by two patents, dated October 15, 1872, and December 2, 1873.

Further particulars may be obtained by addressing the inventor, Mr. Isaac N. Deardorff, Canal Dover Tuscarawas county, Ohio.

Fig. 1

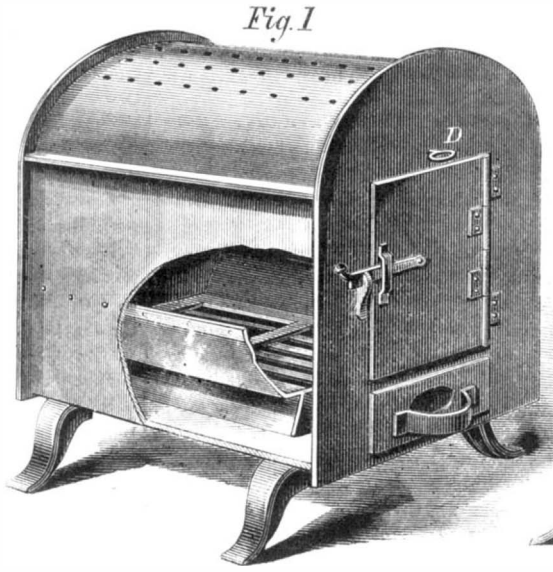
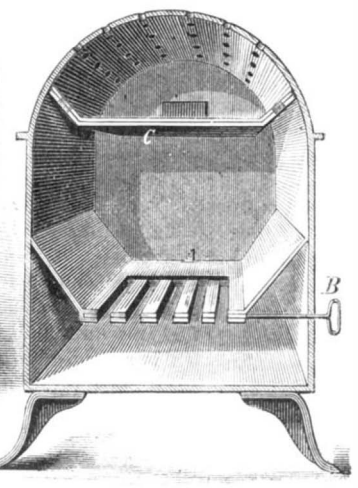


Fig. 2



DEARDORFF'S STOVE FOR SMOKE HOUSES.

IMPROVED TURBINE WHEEL.

The invention herewith illustrated is an improvement in the gates and chutes of a turbine, in order that an unbroken sheet of water may be admitted to strike the wheel without becoming expanded or interrupted, and this whether the gate be fully or partially open. The issues or guide chutes are opened from their inner ends, and the water brought at once in contact with the buckets of the wheel. By this means, it is claimed, the greatest possible percentage of power with a partially drawn gate is obtained, and it is said that there is no decrease of power when the gates are partially closed. The inventor asserts that, if there be any loss, it must be when the issues are fully open.

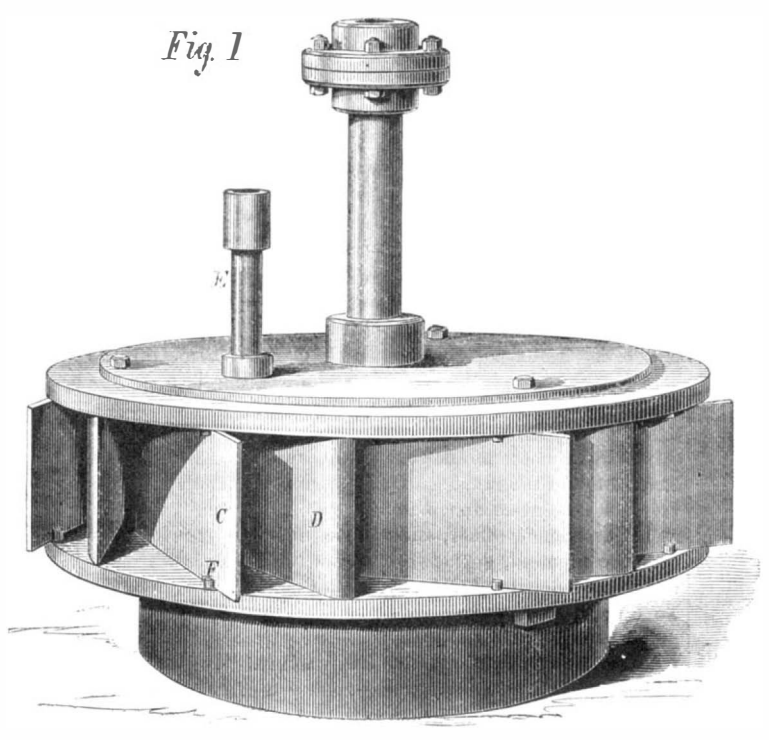
Fig. 1 shows the device in perspective, and Figs. 2 and 3 are respectively vertical and horizontal sections. A, in the latter illustrations, is a rotating gate placed between the top and bottom plates, and resting on the top of the tail water tube, as represented in Fig. 2. In this are made openings, B, which correspond to the buckets of the wheel and form thwarts for admission of the water. To one side of each aperture are keyed the adjustable wings, C, which guide the water, in connection with the curved chutes, D. The latter extend, in part, along the circumference of the wheel and then turn outwardly. On the inner periphery of the gate, A, is a rack, in which a pinion on the vertical rod, E, engages, by which mechanism the gate is rotated so as to open the orifices, B, more or less, as desired. The wings are guided by pins, F, when the ring, A, is turned, and thereby the equal flow of water for the different positions of the latter is secured, it is claimed, without break or interruption.

This construction, it will be noted, is quite simple, and obviates the use of considerable mechanism. The whole curb, it is stated, by suitably reversing it when down, can be applied to either a right or a left hand wheel. The two sets of patterns ordinarily required for casting either description of wheel are consequently not needed, thus adding to the economy of the apparatus. The gate will open under high heads about as readily as under low ones, as the only force to be overcome is the mere weight of the ring which supports the pressure. The appliance, being thus balanced under all heads, is well fitted for the application of a governor. The device is also claimed to be free from danger of injury or obstruction from anything that can come into the guides. The chutes also cannot interfere with the gate and prevent its operation. The invention is said to be applicable to any and all of the class of wheels called vertical, whether they discharge the water downward, centrally, or outward.

The use of the internal circular gate also, it is believed, permits of the constructing of a cheap wheel of wood, by setting the guide chutes of blocks of that material between the floor of the flume and the upper curb of plank, and griping with scantling frame. The ring may be made of square bar iron rolled in circular form, and plates of boiler iron cut to required width and length, and fastened to the circle by rivets. In time of drought, the quantity of water used may be regulated by attaching strips of plank upon the faces of the guide chutes.

Patented through the Scientific American Patent Agency, September 9, 1873. For further particulars address the inventor, Mr. Angus A. Herriman, Owen Sound, Ontario, Canada.

Fig. 1



HERRIMAN'S IMPROVED TURBINE WHEEL.

Fig. 2

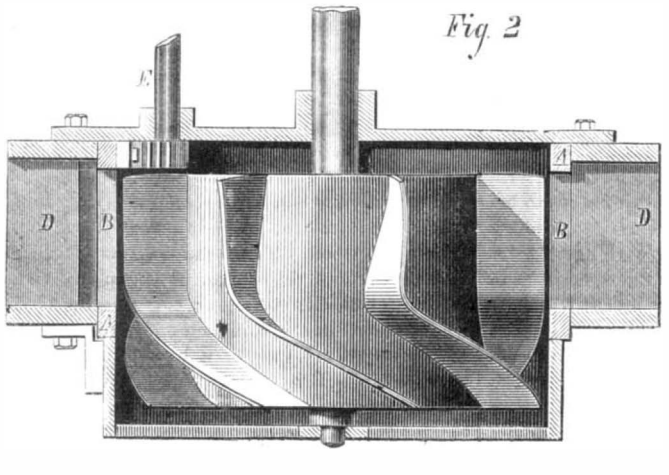
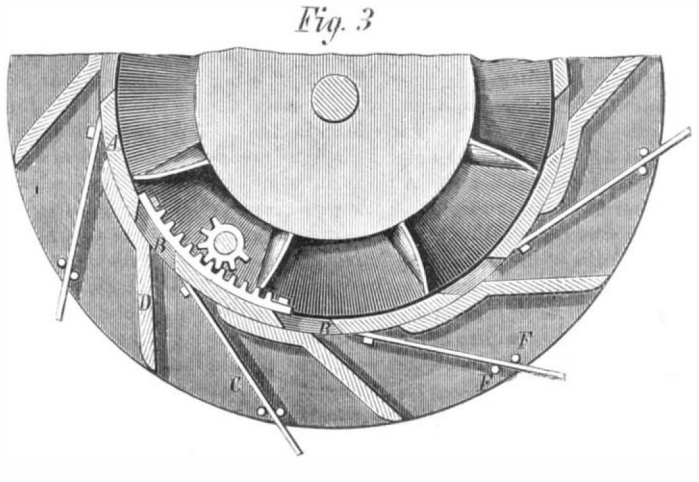


Fig. 3



Electro-Sympathetic Clocks.

Among the many objects of interest in the recent Art Exhibition of Dundee, perhaps few things excited more interest among the visitors than a clock worked by electricity in connection with a normal or master clock. Messrs. Ritchie and Sons, of Edinburgh, whose names are familiar in connection with the time-gun signal, introduced the system some time since, and this system the present clocks are intended to illustrate. The master clock, which is one merely of an ordinary kind, requiring to be wound up periodically, is placed on the platform of the large hall. The oscillations of its pendulum are used to complete contact between the poles of a galvanic battery on the top of the clock case. There are two cells of the ordinary Daniell's sulphate of copper battery, one pole of each being placed in metallic connection with the gas pipe, and the other pole terminating in a slender spring, against which the pendulum rod impinges; and while contact is thus obtained alternately with one or other spring, a current of positive or negative electricity is sent through the pendulum rod, along the insulated wire connected with it to the other end of the hall, where the sympathetic clock is placed. This differs from previous electric clocks, and is provided with a magnetic pendulum, consisting of a wooden rod having a hollow coil or bobbin of insulated copper wire, the ends of which are attached to the suspension springs on which the pendulum is hung. A double bundle of permanent magnets is fixed in the center of this bobbin, their similar poles being placed towards each other. An attraction to and repulsion from the poles of the magnet hung in the center of the coil is caused by the passage of the currents of electricity through the wire coil of the pendulum, in which motion is thus produced and maintained. The makers have constructed a simple but effective escapement, or rather propelment, by which two arms are alternately raised by the pendulum out of action with the record wheel of the clockwork, and when released, by mere force of gravity, push forward the wheel work and hands by sudden and decided steps, which are thus registered by the hands of the clock. There is such a peculiarity in the construction of the pallets that no probable force can push forward the hands beyond the fixed stops, and no power less than the weight of the gravity arm will drive the wheel work backwards.

The difference between this system and that which works electric clocks hitherto in use is that the passing currents of electricity are employed merely to maintain motion in the pendulum, which is effected by a very weak battery; and from the great momentum, these currents may be intermitted or the wire cut for even two minutes at a time without destroying the coincidence of time shown by the sympathetic clock, which is dependent on the motion of its own pendulum, and not in any way upon the power of the battery. This allows the opportunity of causing several clocks attached to the same wire circuit to report their accuracy by making each clock at a certain second to cut the wire connection during that second, and thus the flow of the current is prevented. By means of a galvanometer placed in the wire these dropped seconds are observed, and the correctness of the respective clocks guaranteed. Whatever the number of clocks placed on the same wire circuit, all of them will, of course, act in unison with the beat of the normal or master clock.—*The Engineer.*

Coffee and Milk as an Aliment.

The stimulating and tonic effect of coffee alone is well known, and also the value of milk alone as an aliment, and of them both when taken alone at long intervals. Abbé Moigno states, however, that when mixed they form a compound absolutely indigestible and unassimilable He attributes this to the fact that coffee is rich in tannin, and that its mixture with milk transforms the albumen and casein into a sort of indigestible and imputrescible substance, as is formed in the tan vat when animal tissue is placed in it.

To Improve the Adhesion of Gum Arabic.

—It is a well known fact that gum arabic will not cause some kinds of blotting paper to adhere. This may be remedied by adding, to eight ounces of the concentrated solution, 16 grains of aluminum sulphate. Alum answers also, but not so well.

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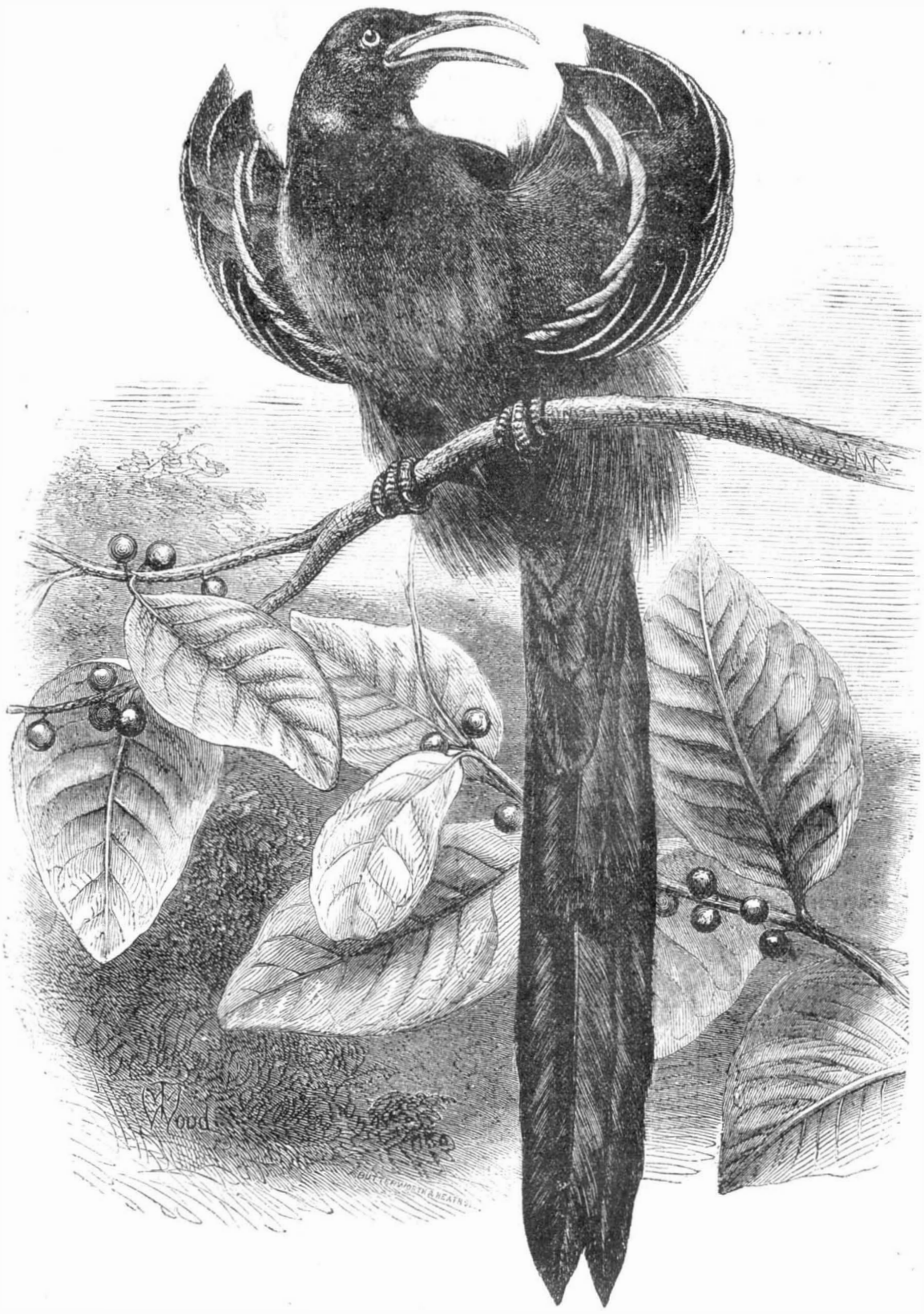
A NEW BIRD OF PARADISE.

Three species of birds of Paradise, hitherto unknown to ornithologists, have recently been discovered in the islands of the Malayan archipelago, the aboriginal home of all the tribe. We illustrate herewith one of the thin billed kind, named (after the eminent naturalist Elliott) the *epimachus Ellioti*.

Before presenting this interesting novelty to our readers, we may glance for a moment at the other members of the family to which it belongs. It is but of late years that birds of Paradise have reached us in a perfect state, although for more than a century the natives of the Molucca Islands seem to have been aware of their value, and to have employed them as articles of commerce. The British Museum, in common with other collections, still contains examples of Paradise birds with mutilated wings and without feet; and this was so generally their condition that two skins of *Paradieea papuana*, in that national collection, were thought to be splendid examples in their day, since they actually possessed the latter.

The specimen we herewith illustrate forms a second species of the genus *epimachus*, the only representative of which was *e. speciosus*, from New Guinea, a bird which, if remarkable for its plumage, was at least one of the oldest and best known of the birds of Paradise. It is therefore of great interest to procure a second and thoroughly distinct species after the lapse of so many years. It is easily distinguished from its ally by its violet or purple tail, in addition to its small size: and, regarding its plumage, we quote (says the London *Field*, from which we take the illustration) the following remarks from Mr. Elliott's work:

The *epimachus Ellioti* is only about two thirds the size of its large relative (*e. speciosus*); but it is possessed of far more brilliant colors in its plumage, and in the sunlight must present a beautiful appearance indeed, as its rich velvety feathers show off their changeable hues of purple and green, with the metallic colors of the tips of the side plumes flashing on the eye as the bird raises them tremblingly over its wings. The broad tail feathers, with their amethyst dyes, look not unlike watered silk, and are of a velvety softness, as is indeed the entire plumage of the body.



A NEW BIRD OF PARADISE.

Essential Oils.

Essential oils are volatile, and may be distilled without decomposition; they are the product of flowers, plants, fruits, or the juice of certain odoriferous woods. Essential oils differ from the fixed oils obtained from fatty substances; for while the latter are compounds of glycerin and fatty acids, the former are generally hydrocarbons, but sometimes contain also oxygen and sulphur. The fixed oils combine with alkalies to form soaps, but the essential oils do not. All essential oils have powerful odors, and many of them have a hot, aromatic taste. The odor is sometimes agreeable, and at other times repulsive. The most fragrant are oil of rose, jessamine, tuberose, orange flowers, heliotrope, violet, bergamot, and lavender. Paper is rendered permanently transparent by an application of fixed oils; but only temporarily so by the use of volatile preparations. Essential oils are soluble in alcohol and ether; but only partially so when immersed in water. Many of them are found ready formed in plants, and give the peculiar odor to the leaves, flowers, and fruits which make the acquaintance of our olfactories.

The volatile oils are, in many instances, isomeric, that is, composed of the same elements and the same proportions, but with different properties. Chemical science, however, has not yet been able to convert the one into the other, most probably on account of the different groupings of the same number of elements.

Oil of lemon and oil of orange peel are obtained by placing the rinds in a linen cloth and subjecting them to a powerful pressure between iron plates. The vessel in which the pressure is applied should have a discharge pipe at the bottom. The oils thus obtained are impure, but extraneous matter is separated by careful filtration. Orange flowers, or neroli, has the same chemical composition as the above, but is possessed of more fragrance. In obtaining the last named, more care is necessary, and the petals are subjected to distillation with the vapor of water. Oil of orange flowers, when fresh from the still, is almost colorless; but by age and exposure it soon acquires a red color. It is easily rendered soluble in alcohol, and is extensively used in the manufacture of cologne water. Oil of rose is the most expensive as well as the most fragrant of all the essential oils. There are two varieties of this article, one of which is obtained from the East Indies, and is the product of the *rosa moschata;* the other comes from the Levant, and is obtained from *rosa sempervirens*. In the east, the petals of the rose and other flowers are collected, immersed in spring water, and afterward exposed to the direct rays of the sun. In the course of a few days yellow drops of oil collect on top, and are taken up by a bunch of cotton tied to the end of a stick. When sufficient is gathered in this way, the oil is pressed out of the cotton. In some sections the whole flower is subjected to distillation, the calyx remaining entire as it is plucked from the stem. In Egypt the petals of flowers, and especially roses, are subjected to distillation with water in copper stills. Some manufacturers of essential oils place alternate layers of rose leaves and sesame seeds in a vessel, where they are allowed to remain about a fortnight, when fresh layers of roses are added, and this operation is repeated several times, or until the seeds have absorbed sufficient oil, when they are subjected to pressure, the rose oil collecting on top, and the oil of the sesame seeds separating and settling to the bottom. Oil of rose is a thick yellow liquid, which solidifies at a low temperature, and becomes a viscid mass. When concentrated, its odor is so strong as to cause headache, and it is only when diluted that its fragrance can be best appreciated. Its sweetness is not injured by the action of sulphuric acid.

There are said to be over one hundred varieties of essential oils, very similar in chemical properties, but differing greatly in taste and smell. The oil is bidden away in little cells which require to be broken before the flower exudes its real fragrance. Violet, heliotrope, and several other delicate perfumes are subjected to infusion and absorption in melted tallow or lard, and in this manner their oil is secured.

Jessamine, tuberose, and other flowers that are injured by heat are subjected to absorption alone. This process is extensively used in several parts of France, and is termed *enfleurage*. Oil of camphor is obtained from the wood or gum by distillation with water; it is subsequently purified by repeated sublimation. The wood, however, is the most generally used for this purpose. It is insoluble in water, but easily soluble in alcohol, ether, and the fixed oils. Oil of turpentine is obtained by distilling the crude juice alone or in water, and is made pure by repeated rectification with water. It is a colorless liquid with a strong aromatic but disagreeable odor. It is of great value in the arts, and for medicinal purposes. Oil of juniper has a different composition, but is obtained from fresh berries after being pounded thoroughly and macerated several hours in water. The subsequent process of distillation is much the same as in respect to turpentine. Oils of sassafras and hemlock are obtained in a manner similar to the distillation of most woods and barks, but require very careful preparation, as well as application of the required means to obtain satisfactory and profitable results.—*New York Mercantile Journal.*

Dry Plate Photography.

Mr. H. Houlgrave gives the following formula: He mixed thirty grains of crystallized bromide of cadmium and fifteen grains of pyroxylin with one ounce of ether and one ounce of alcohol, cotton giving a powdery collodion, not succeeding like one that gave a tough film In a level stereo-developing glass dish, he poured one ounce of the above, and, after leaving it for about two hours to set, he filled up the dish with his bath solution of silver, of about seventy grains strength. After a time he raised the film with a silver fruit knife to allow the solution to flow underneath, and left it to soak a little longer. After pouring off the bath solution he poured on his first washing water, which, from constant use, contained about five grains of silver to the ounce. This was left on the film about half an hour, and then saved for future use. The dish was then filled up with rain water, leaving it two or three hours, and washing again until all milkiness had disappeared. After well draining, the film was hung up to dry by artificial heat, as it took too long to dry otherwise. The pellicle was then of a very horny nature, and could be cut and kept till wanted; of course the washing had to be conducted in the dark room. With one ounce of the pellicle, he made two ounces of emulsion by adding equal quantities of ether and alcohol, and to that quantity he added forty minims of a sixty-grain tannin solution. When the pellicle dissolved—which took some time unless constantly shaken up—he coated his plates, placing them at once in his drying box without any further washing, using no substratum. He preferred an edging of india rubber solution before pouring on the emulsion. In development he first moistened his plates with pure alcohol, washed with water, and then developed with a three-grain solution of pyrogallic acid, adding one drop of a twenty-grain solution of bromide of potassium and one drop of a sixty-grain solution of bicarbonate of ammonia.

DURING the past ten years, the screw has entirely replaced the paddle in transatlantic navigation, the weight of marine engines has diminished one half, the steam pressure has quadrupled, and the consumption of coal has decreased two thirds.

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ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am ndebted to students. M.M.

Positions of Planets for April, 1874.

Mercury.

This planet, which was so beautiful in the evening twilight in March, rises in April before the sun, and should be ooked for in the morning. Its declination is so much farher south than in March that it cannot be so well seen.

On the 1st of April, Mercury rises about 5 A. M., and sets at 4h. 31m. P. M. On the 30th, Mercury rises at 4h. 19m. A. M., and sets at 4h. 47m. P. M.

Venus.

On the 1st of April, Venus rises at 6h. 14m. A. M., and sets at 7h. 6m. P. M. On the 30th, Venus rises at 5h. 49m. A. M., and sets at 8h. 19m. P. M.

Venus should be seen after sunset, almost directly in the s un's path on the first half of the month; after that date it will be further north than the sun and can be seen for some time after sunset. Venus and the moon will be in conjunction on the 17th.

Mars.

Mars will at present scarcely repay the observer who attempts to study its phenomena, even with the aid of a good telescope.

On the 1st, Mars rises at 6h. 51m. A. M., and sets at 8h. 35m. P.M. On the 30th, Mars rises at 5h. 54m. A. M., and sets at 8h. 30m. P. M.

Jupiter.

On April 1, Jupiter rises at 4h. 50m. P. M., and sets at 5h. 14m. A. M. On the 30th, it rises at 2h. 43m. P. M., and sets at 3h. 15m. the next morning.

Jupiter is the great beauty of our evening skies all through the month. It should be observed between 9 P. M. and midnight, when it is not far from meridian. Its motion among the stars is retrograde, or toward the west, and it is so great that from night to night its change of place can be detected.

The phenomena resulting from the motions of the satellites on the 7th and 15th of the month are very interesting, and some of them can be seen with a small telescope. On the 7th the fourth satellite will disappear by eclipse—it will pass into the shadow of Jupiter, and before it comes out the first satellite will disappear by transit—that is, it will be projected on the face of Jupiter and will be lost in the light of the planet.

On the evening of the 15th, the fourth and second satellites of Jupiter make transits across the face of the planet nearly at the same time; with a powerful telescope both will be seen projected on the disk, but they cannot be detected by a telescope of low power; they will be lost in the light of Jupiter, and the planet will seem to have but two moons.

Saturn.

Saturn is very unfavorably situated, as it is far south, rises in the early morning and sets on the 1st a little after 1 P.M. and on the 30th before noon.

Uranus.

Uranus is well situated for observation, but requires a a pretty good telescope to render it interesting. It rises on April 1 at 0h. 42m. P. M., and sets at 3h. 7m. the next morning. On the 30th, Uranus rises at 10h. 49m. A. M., having set at 1h. 18m. on the morning of that day.

Neptune.

It is useless to attempt observations on Neptune at present. It comes to the meridian nearly at the same time with the sun, and makes nearly the same diurnal path.

Meteors.

But few meteors have been seen during February and the first half of March. The only one reported of any considerable size was seen on February 28, south of Sirius, at 8h. 30m. P. M. The moon was nearly full, yet it appeared brighter than Jupiter. Several meteors were seen between 8 and 9 P. M. of the 15th of March.

Barometer and Thermometer.

The meteorological journal from February 14 to March 14 gives the highest barometer, February 25, 30·51; the lowest barometer, March 10, 29·46; the highest thermometer, March 4, at 2 P. M., 53°; the lowest thermometer, February 18, at 7 A. M., 11°.

Amount of Rain.

The rain which fell during the night of February 20 amounted to 0·21 inches.

The rain which fell between the afternoon of February 22 and the morning of February 23 amounted to 0·28 inches.

The rain which fell during the night of March 3 and the morning of March 4 amounted to 0·16 inches.

A Street Fire.

In this city, recently, a one horse truck laden with twenty-seven cases of naphtha was being driven up Third avenue by an employee of the Gas Meter's Saving Company. When near 14th street, the driver struck a match and threw the end of it among the cans. In an instant the whole contents were in a blaze. The driver sprang out and left the vehicle to its fate. The horse, a fine young animal, reared and plunged with fright, but the traces and harness confined him to the burning pile. Superintendent Hartfield, of Mr. Bergh's socity, riding up on a car, sprang off at the spot, and, under a scorching fire, unhitched the animal and saved it from a horrible death. In ten minutes the wagon was a small heap of charred fragments. The flames reached the top story of the house at the corner of 13th street and Third avenue. An alarm of fire was sounded by telegraph, and the hook and ladder apparatus was quickly on the spot and assisted to put out the flames.

The Basking Shark.

An interesting ichthyological discovery has lately been made by Professor Steenstrup, of Copenhagen. He finds that certain comblike bodies, which have been supposed to be appendages of the skin of certain sharks, are really shifting organs appended to the interior of the gill apertures of the basking shark; and he infers that this fish, the largest shark of the northern regions, which attains a length of thirty-five feet or more, lives, like the still more gigantic whales, upon the bodies of small marine animals strained from the water by these peculiar fringes. The very fine rays composing the fringes are five or six inches long, and were some years ago shown by Professor Hanover to consist of dentine, so that each of them may be regarded as, to a certain extent, the analogue of a tooth. It is remarkable that Bishop Gunnerus, who originally described the basking shark (*selachus maximus*) and regarded it as the fish that swallowed the prophet Jonah, noticed the existence of these branchial sieves more than a century ago.—*Science Gossip.*

PRIZE FOR AN ALCOHOLOMETER.—M. Léon Say has proposed to one of the commissions of the French Assembly that a prize of 200 francs should be offered for the discovery of a process by which it may be possible to determine immediately and practically the amount of alcohol in any mixture, no matter how composed. The commission voted unanimously in favor of the proposal, and M. Dampierre was charged to draw up a report on the subject.

A REDDISH BROWN PAINT FOR WOOD.—The wood is first washed with a solution of 1 lb. cupric sulphate in 1 gallon of water, and then with ½ lb. potasssum ferrocyanide dissolved in 1 gallon of water. The resulting brown cupric ferrocyanide withstands the weather, and is not attacked by insects. It may be covered, if desired, with a coat of linseed oil varnish.

Mr. W. R. Norris, the inventor of the diagonal planer illustrated on page 198 of our last issue, desires us to state that the capacity for work of his machine is fifty doors, each 2 feet 6 inches by 6 feet 6 inches, per hour, and not per day, as stated in the description.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medi m through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 24 to March 2, 1874, inclusive.

CARTRIDGE MACHINERY.—C. H. Webb, Brooklyn, N. Y.

CORRUGATING MACHINE.—H. W. Lafferty *et al.*, Gloucester, N. J.

EMERY GRINDING.—C. Heaton (of New York city), London, England.

FEED WATER HEATER, ETC.—I. P. Magoon, St. Johnsbury, Vt.

FLOOR COVERING.—J. L. Kendall, Foxboro', Mass.

JOURNAL BOX.—J. N. Smith, Jersey city, N. J.

LOOM HARNESS, ETC.—J. Sladdin, Lawrence, Mass.

PRESERVING EGGS.—D. Miles, Boston, Mass.

SEWING MACHINE.—I. M. Singer (of New York city), Paignton, England.

TWISTING FRINGE.—W. Brooks, Remington, Vt.

DECISIONS OF THE COURTS.

Supreme Court---District of Columbia.

CONKLIN AND STAFFORD.—PATENT STRADDLING CULTIVATOR.

[Application for reissue.—Appeal from the Commissioner of Patents.—Decision March 2, 1874.]

Opinion of the court delivered by MacArthur, Judge:

The appeal in this case is from a decision of the Commissioner of Patents refusing to grant a reissue of a patent to the representatives of a deceased inventor. The refusal to allow the reissue is placed by the Commissioner on the ground that the claims for which the reissue is denied have been abandoned to the public use, and are, therefore, not patentable. The facts of the case are as follows:

Daniel S. Stafford made application for letters patent August 30, 1860, for a new and useful improvement in corn cultivators, which he described in his specification as that kind of cultivator that can be raised or lowered, or turned to the right or left, by the operator from his seat on the machine, so as to adapt the machine for passing over or turning to one side of an obstruction, or to cause it to follow the crooks in the rows of plants. And this is followed by an elaborate description of the invention in all its details. The original patent was issued to him January 15, 1861, embracing three claims: First, the combination which enabled the driver to guide the machine so as to follow the crooks in the rows of plants; second, the combination of the seat and the bent axle; and third, the long bent share blades or cutters for the purpose of throwing the loosened soil toward the plants.

In 1866 Daniel S. Stafford died, and on the 13th September, 1870, his assignee and widow, who has since married and is now Mrs. Conklin, filed an application for a reissue, embracing seven claims, five of which were allowed, and two of them were rejected for the reason already mentioned, that Stafford had abandoned the subject matter of such claims previous to the issuing of the original patent. These claims are in the following language:

The combination, in a straddle row cultivator, of two wheels, B, an axle, C, frame, A, and series of plows, G, arranged in two gangs, so as to till or cultivate the soil on both sides of a single row of plants simultaneously as set forth.

Also the combination, in a straddle row cultivator, of two wheels, B, an axle, C, frame, A, series of plows, G, arranged in two gangs, and a seat, E, for the driver, for the purposes set forth.

The application for the reissue was necessarily made under the fifty-third section of the revised patent law of 1870, which seems to be the only provision in the statute authorizing the Commissioner to issue a new patent for the same invention. This section declares that whenever any patent is inoperative or invalid, by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner is authorized, on the surrender of such patent, to cause a new one to be issued, with corrected specifications.

It will be seen by the terms of the statute that in order to entitle a party to the reissue of a patent it is incumbent on him to show that it is inoperative or invalid by reason of a defective or insufficient specification, or that the patentee had claimed more than he invented, and that the error had arisen by inadvertence, accident, or mistake, and without any fraudulent intention. Unless these circumstances exist in an application of this character, I can find no authority by which the Commissioner can reissue a patent; as he is an officer of special and limited power, his action must be restricted to the particular cases mentioned in the statute. I refer to these requirements of law, because if the original patent is neither inoperative nor invalid, and if no error has been occasioned by accident or mistake, there must be a presumption of law and fact that the patentee has abandoned to the use of the public everything which he may have invented, but which he did not include in his claims and specifications. The law presumes that every one who applies for a patent will embody his invention in specifications sufficiently definite to preserve as much of his discovery as he desires to protect by a patent. If, from mistake, he has overlooked anything within the scope of his invention, he may surrender his patent on that ground, and claim a new one, in accordance with amended specifications. The party asking this relief must be denied it unless he brings himself within the statute. When he knows all the facts relating to his own case, but, through culpable negligence or misconduct, has failed to claim all of his discovery, the law will not extend its aid to him, but will leave him to enjoy only such limited advantages as he has actually secured. The law reserves its remedies for the careful and vigilant who may have been misled from any of the causes mentioned in the statute.

Courts of equity very often grant relief in cases of mistake when a meritorious case is established by the pleadings and proofs; but the remedy is regulated by well established rules of law, and undoubtedly Congress had the same rules in view when it extended this remedy to similar cases under the patent law which they enacted.

It is conceded that the Supreme Court has decided in several cases that the granting of a reissued patent closes all inquiry into the existence of inadvertency, accident, or mistake. A presumption then arises that the proofs have been regularly made, and that they were satisfactory. "No other tribunal is at liberty to re-examine or controvert the sufficiency of such proofs if laid before him when the law has made such officer the proper judge of their sufficiency and competency." (Railway *vs.* Stimpson, 14 Peters, 459. Seymour *vs.* Osborne, 11 Wall., 542.)

In the case at bar no such presumption arises, for the patent has not issued, and the proofs are before us to be examined and weighed, and we are called upon, as preliminary to the granting of the patent, to judge of the sufficiency and competency of the proofs to sustain the application in conformity to the essential requisites of the statute. The decisions referred to can have no application to an appeal of this kind.

In this case Stafford during his lifetime never pretended to any one that his patent was inoperative, or that the specifications were defective in any respect, or that he had omitted or added accidentally or by mistake. On the contrary he always claimed for it the highest merit and practical utility. The evidence in the case of Sayles *vs.* Hapgood, used by consent on this application, establishes beyond any doubt that it was a valuable invention, and, as one of the witnesses expresses it, a strong, durable, and efficient farmimplement. It appears that more than 15,000 of the machines had been manufactured under the patent up to the time of his death in 1866, and sold to the public. Another circumstance of much significance is not to be overlooked in this connection, and it is that, after the original patent had been obtained, Stafford made further improvements upon the same cultivator, and for one of these he procured a distinct and independent patent. About three weeks before he died he gave his brother a description of a model for another improvement, which was patented after his death; and during all the time he was employed in devising models of new improvements upon his invention there is not a particle of evidence tending to show that he claimed there was anything wanting in the specifications which he had filed in the Patent Office when he obtained the original patent in 1861.

It seems quite clear, upon this state of the case, that Stafford never intended to patent more than he had carefully and definitely described in his original application, and that everything else which he might have invented up to that period was abandoned to the public. This intention is clearly indicated by his acts, and is as fully proved as it is possible to prove the purposes of one now dead.

It is noticeable that the application for the reissue states none of the causes mentioned in the statute for which a new patent might be issued, and careful examinations of the proofs discloses the fact that not a particle of evidence has been taken to sustain these pre requisites of the law. No presumption can prevail here that the proofs have been made, as would be the case if a patent had issued, and the only rational belief that can arise upon the case as it now stands is that Stafford abandoned what he did not include in his specifications.

We are aware that the Commissioner has presumed abandonment from what he deems proof of the public use of the invention for several years previous to the issuing of the original patent. While we may not be satisfied that a public use is shown of such a character as to establish abandonment, yet the testimony on this subject, taken in connection with the facts I have already mentioned, adds considerable force to the presumption that Stafford never intended to patent what is now claimed.

He made his first machine in 1852, and it comprehended in a rude form all the elements of the combination for which in 1861 he obtained a patent. It was a two wheeled straddle row cultivator, with plows on each side, so as to cultivate a whole row at a time, with a seat for the driver, drawn by two mules, and did as good work as a single plow. To explain the delay which took place from his first machine, in 1852, until he obtained his patent, eighteen years afterward, in 1861, the appellants claimed to have proved by the testimony of several witnesses that during all that time Stafford was in poor health, and was greatly embarrassed in his circumstances; that he was employed from time to time in improving his invention, and constantly declared his intention to obtain a patent as soon as he could procure the means. Whether this was the real cause of delay or not, such a protracted period of reflection and experiment afforded him extraordinary opportunities to ascertain and describe his claim with precision and accuracy.

There is no proof that he was not entirely satisfied with what he did. The application for the reissue is not made until 1871, a period of nearly five years after his death, and thirty years after he had reduced his invention to a practical form. In the meantime at least one hundred distinct patents have been issued for cultivators, and the numerous manufacturers in the west and northwest are respectively manufacturing on a patent of their own. The art has probably received many valuable additions from the efforts of so many persons; but if the claim of these appellants be allowed they would have a monopoly of every form of cultivator with wheels, axles, plows, and a seat for the driver.

It would, indeed, be a patent for a cultivator generally. Such a claim should not be assented to unless it can be shown with reasonable certainty that, if patentable at all, it has never been deserted and abandoned by the inventor.

We are of the opinion that the decision of the Commissioner should be affirmed.

Some discussion occurred during the argument concerning the jurisdiction of this court on an appeal from a decision of the Commissioner of Patents. The forty-eighth section of the act provides for the appeal, and the next section directs that the appellant shall file in the Patent Office his reasons of appeal in writing, and the fiftieth section enacts that the court shall revise the decision appealed from, and that such revision shall be confined to the point set forth in the reasons of appeal. A majority of the court are of opinion that by a true interpretation of those sections we can only examine into the reasons of appeal, and the record and proceedings, so far as they apply thereto, for the purpose of ascertaining whether the Commissioner has made an erroneous decision; and that we cannot revise the decision on any other ground than that upon which the application was rejected. In the case now under consideration the reissue was denied for the reason that the inventor had abandoned to public use the subject matter of his two claims, and the appellants assign their reasons for appealing to be that the Commissioner erred in refusing the claim on the ground of abandonment. The issue is thus clearly defined in the mode designated by the law, and we are forbidden to set the decision aside on any other ground. Nor can we go into the record at large for the general purpose of seeing whether the decision is right on some other ground, not passed upon by the Commissioner nor stated in the reasons of appeal.

It has been suggested that a case may occur in which the true grounds of error are not set forth in the reasons of appeal, and yet the decision be sustainable on some other ground. It is, however, a sufficient answer to this view that it is not our duty to put a forced construction on statutes to remedy supposed evils. Besides, if the party wishes to test his general right to a patent, he can do so under the fifty-second section, which declares that he may have a bill in a court of equity if he has been refused one by the Commissioner.

We have deemed it proper to dispose of this point in the present case for the purpose of settling the practice on a disputed point in this class of cases.

On the question of jurisdiction, Judge Olin dissented.

* * * The Commissioner, he says, as near as I understand the reason assigned by him for his refusal to reissue this patent with the improved specifications proposed, holds that where a patentee has been experimenting by way of improving his machine for a period of about twenty years, and then applies for a patent for his improvements, and a patent is granted for all he asks as his invention, and after the lapse of some eight or ten years, during which this machine has been manufactured and scattered broadcast over the country, the patentee shall be deemed to have abandoned to public use all such inventions or devices in the original patent for which he did not ask protection in his application for the original patent granted him.

I think the reasoning of the Commissioner by which he arrived at that conclusion is sound; and still I think he might well have placed his decision upon the ground that, by law, the facts of this case did not authorize the reissue of the Stafford patent. * * *

No new matter, the statute says, shall be introduced into the specifications, nor, in case of a machine patent, shall the model or drawings be amended except each by the other.

What is here meant by the statute which says that upon the reissue of a patent "*no new matter* shall be introduced into the specification," etc.? I understand it to mean this, and this only, that upon the reissue of a patent, the patentee is allowed to surrender his specifications in such a way as to render valid and operative the patent originally granted, but that no new matter shall be introduced into the reissued patent which was not claimed in the original application and specifications. By new matter is here obviously meant setting up a new claim for some patentable device or invention which was not claimed in the original patent. My conclusion is, therefore, that this case, all the facts appearing before us, did not authorize the Commissioner of Patents to grant a reissue of the patent in this case. * * *

From the claims, as set forth in this application for a reissue of the Stafford patent, it will be clearly seen that an attempt is made to *straddle over* every possible invention and improvement known in this kind of machine, and to render them all subject to the payment of a royalty to the assignee of Stafford, and to his widow, Mrs. Conklin.

Well, we think the Commissioner might have paused before granting such an extraordinary claim.

E. L. Stanton and *A. MacCallum*, counsel for appellant.

Marcus S. Hopkins, for the Commissioner of Patents.

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Recent American and Foreign Patents.

Improved Spring Bottom Cot.

Francis E. Lord and Herman K. Blanchard, Cambridgeport, Mass.—The frame consists of two side bars connected at their ends by two cross strips and near their ends by two cross bars. The legs are pivoted to the side bars, and the lower parts of each pair are connected by a cross strip. In the ends of the cross strips are formed slots, the inner parts of which are made sufficiently large to receive the heads of the braces, and their outer parts are made narrow to fit upon the necks of said braces. The latter are pivoted to the side bars in such a position that their heads, when the legs are extended, may pass through the larger parts of the slots in the cross strips. The braces are then slipped close up to the legs, which brings their necks into the narrow parts of the slots in the cross strips, and securely fastens the said legs in place. This construction enables the legs and braces to be turned up along the inner sides of the side bars, so as to be entirely out of the way, and adapt the cot for use as a bed bottom, or enable it to be compactly packed for transportation or storage.

Improved Sawing Machine.

Harvey Morey and Samuel H. Bellah, Cameron, Tex.—A frame, mounted on a low truck, has horizontal ways for a saw frame to slide forward and backward in, the saw projecting at one side of the frame. The frame is also provided with vertical ways, into which the saw can be shifted when it is desired to saw felled trees into blocks. This saw frame has a forked pitman rod attached to each end, one of which is connected directly to the crank of a driving shaft, and the other is connected to a rock lever, which is connected to another crank on said shaft, the two cranks being arranged at opposite sides of the axis. The saw frame has a feed screw, so arranged that it can feed the frame forward and back, while said frame reciprocates to work the saw.

Improved Device for Emptying Carboys.

Hugh R. F. Koechling, New York city.—This is an improved device for removing acids and other liquids from carboys and other vessels by atmospheric pressure, and without agitating said liquids or disturbing any sediment that may be in said vessels. By suitable construction, when the piston of an air pump is drawn upward, an upper valve is closed by the pressure of the air within the bottle, preventing the escape of the air from the latter. A lower valve is then raised by the pressure of the outer air, allowing said outer air to enter the barrel of the air pump. As the piston is forced downward, the pressure of the air forced out of the barrel closes the lower valve, and, opening the upper valve, passes into the bottle, where its pressure will force the liquid contained in said bottle out through a siphon-shaped tube into the receiver.

Improved Cultivator and Plow.

James B. Lucas, Pellsville, Ill.—The axle is bent four times to form a middle bow. The tongue is secured to the hounds, and the rear part of the latter to the axle, near its outer bends. Braces are attached to the axle and to the hounds. To the forward end of the plow beam are secured the ends of two bars, which are pivoted to couplings, by which they are connected with the axle. Another brace bar is pivoted to a coupling, by which it is connected to the axle, and is placed upon the mold board side of the beam, its rear end being bent to lie along the side of the said beam, and to pass through the loop of the coupling attached to the plow beam. This construction allows the plow to have enough lateral movement to pass around stones and other obstructions, and to enable it to be raised and swung beneath the framework of the machine. By operating a lever, the forward end of the plow beam may be raised from the ground, allowing the plow to run upon its foot or heel.

Improved Packing Box.

William D. Woodruff, Louisville, Ky.—The bottom has cleats fastened upon the upper side along the edges, and projecting at the ends. The top of the box has similar cleats on the under side. The side pieces extend beyond the ends of the top and bottom boards as far as cleats do, and they also have a cleat extending across the inside at each end. The end boards have a cleat at the lower end, extending across the inside. To set up the box, the bottom is laid at the ends on the cleats of the end pieces, which are set upright; the side pieces are then laid at their lower edges on the bottom, between the edges of the end pieces and cleats. Then, after filling the box, the top is laid on between the upper projecting end of the end boards, with its cleats outside of and confining the upper edges of the side boards; then binding cleats are put on between the upper ends of the end pieces and the upper side of the top, and fastened by screws screwed obliquely into the end pieces. To take it apart after unpacking it, the screws are taken out, after which all the parts can be readily separated and packed away in a small pile.

Improved Flour and Middlings Purifier.

George W. Brown, Metropolis, Ill.—The general idea of this invention is to enable the attendant to force any amount of air that may be required into the chest or inside the reel, or both, and withdraw it, as may be required for the different kinds, qualities, and conditions of grain, suitable valves being employed to regulate and control the currents. By long trunks along the top of the chest communicating with two air chambers, air may be blown into the reel space with the pressure fan, or sucked out to draw out impurities with the other. By trunks along the sides of the reel above the fall boards, air is to be forced in below the reel to clean the fall boards and facilitate the descent of the flour to the conveyer below, also to act on the under side of the reel. A perforated tube on the shaft facilitates the separation of the material bolted by the jets of air it lets in from the pressure chamber. Coarse wire wings on the perforated tube separate the material falling on them. A smooth ring, fitted in the enlarged portion of the reel at the mouth of the funnel, carries the remaining unbolted material quickly under or beyond the mouth of the funnel to the coarse tail screen beyond, or to be passed out at the tail end to a receiver below. The funnel is for drawing the impurities out of that portion of the reel through which the fine matters are bolted, while preventing the escape of the coarser particles from the tail portion. The material collecting in the suction chamber is removed from time to time through a suitable aperture therefor in the case, having a gate for closing it.

Improved Cane Harvester.

Felix L. Cervantes, Cardenas, Cuba.—This invention consists of a harvester cutter adapted for cutting a single row of cane, with an endless bottom carrier and two or more side carriers between two high sides of a supporting case. The cane is held vertically, and carried against a series of horizontal saws on a vertical shaft, which cut the cane into short sections for convenience in handling. The tops are also cut off and delivered into a receptacle for fodder, while the cane is passed into a wagon to be conveyed to the sugar mill.

Improved Knit Legging.

Samuel Baron, New York city.—This invention consists of knit leggings for ladies and children, having an extension above the knee with an elastic in the top, and also having a contracted portion immediately below the knee, formed by shortening the stitches, in which elastics may or may not be used. The object is to provide leggings which will cover the knee and a portion of the leg above, and retain their position.

Improved Oil Stone Holder.

Ezra C. W. Hull, Hoosick Falls, N. Y.—This invention consists in an oil stone holder made to revolve on pivots, and having three faces, with adjustable clamps and screws for securing the oil stones. By making the cylinder to hold two or more stones, which may be of different degrees of fineness, it is a great convenience in sharpening tools.

Improved Steel for Sharpening Knives.

Owen W. Taft, Brooklyn, N. Y.—This invention relates to a knife-sharpening steel possessing peculiarities of construction calculated to render it much more efficient and for a longer period than other steels. It consists in a series of blades set radially around a rod or stock, which is attached to a handle of suitable form. These blades are employed for the benefit of the angles of their outer edges for knife-sharpening purposes which are more efficient than can be formed on a steel rod by the concave flutes or grooves, or the file surfaces with which steels are armed their form is better adapted for action on the knife edge; and it is such that the edges do not become dulled by wear, but are adapted to be self-sharpening, or if necessary they can be filed or ground sharp. A patent for this device has also been applied for in England.

Improved Fruit Masher and Sifter.

Charles S. Bucklin, Red Bank, N. J.—This invention is an improved machine for rubbing tomatoes and straining out the seeds in making catsup. The tomatoes are introduced through a hopper, and fall into a semi-cylindrical wire cloth screen, through which they are rubbed by a cam on a longitudinal shaft. They then pass to a lower screen which may be suitably inclined, which is sufficiently fine to prevent the passage of the seeds.

Improved Press.

John W. Fields, Sherman, Texas.—The press case is arranged horizontally, and contains a follower which has guide pulleys on its rod. Ropes pass over these pulleys and around a fixed wheel, by rotating which a to-and-fro motion is imparted to the follower.

Improved Electrode Handle for Medical Use.

Jerome Kidder, New York city.—This invention provides, for electro-medical purposes, an improved double electrode for facilitating the adjustment of the amount of surface required, and the convenience of manipulating the current. It consists of a double electrode, so constructed that both poles of the electric current can be brought to it, and still be insulated from each other, so that one pole of the current will be received in the hand that holds the electrode, while the other pole may be applied to other parts of the body, thus using the same with one hand, leaving the other free for other purposes.

Improved Cultivator.

Isaac Cory, Dalton, Ind.—An arched bar is secured to the driver's seat, so that both may be moved forward or back, to adjust the seat so that the weight of the driver may properly balance the machine. Stirrups for the driver's feet are secured to the rear ends of side bars by the clamps that secure the ends of the arched bar, and may be raised or lowered, as the length of the driver's legs may require. The middle parts of the side bars are connected by an arched bar, the ends of which are secured to said bars, and its middle part depressed to bring it into proper position for the rear end of the tongue to be attached to it, the side bends giving space for the plow handles when the plows are raised from the ground. The forward ends of the side bars are connected by another bar, the end parts of which are horizontal, and the middle part arched to allow the plows to be pivoted in front, the handles to rise up, and the implements to be moved laterally or vertically.

Improved Axle Nut Fastening.

Rolla R. Jones, Pillar Point, N. Y.—This invention consists of a circumferential groove, extending about half around the axle near the end, a pawl in a recess in the bore of the nut, adapted to fall into said groove when the nut is fitted on the axle, and a slide bolt in the nut, adapted to slide over the pawl by the action of a spring, after it has fallen into the groove, and lock it fast, obviating screw threads. The nut is fastened more securely than it can be by screwing on.

Improved Razor.

George A. Whitmarsh, Colton, N. Y., assignor to himself and F. E. Miner, New York city.—This invention has for its object to improve the construction of razors, so that they may be more conveniently and safely held in position to be used. It consists in a razor blade made with a short cutting part and a long shank having a thumb rest formed upon it.

Improved Fountain Pen.

David L. Latourette, New York city.—The penholder consists of a tubular base, which screws to the end of a tubular handle, which is the ink fountain. The ink is shut off from the base by a disk and packing, or ground metallic joint, near the upper end of the latter. A feeding tube extends from this disk down through the base, along the back of the pen, to deliver the ink upon it. A capillary feeder of thread is arranged in the orifice of the feeding tube, and in connection with the back of the pen, to cause an even flow. An adjustable cap is screwed on the lower end of the feeding tube to regulate the flow of ink, and a spring of peculiar construction is combined with the base piece for holding pens of different sizes and forms. This invention was illustrated and described on page 178 of our current volume.

Improved Chair Seat.

Thomas W. Moore, New York city, assignor to Fannie N. Moore, Plainfield, N. J.—A series of springs are arranged parallel to each other, and fastened at each end to opposite sides of the frame. These springs are crimped or corrugated to allow for a proper degree of contraction and expansion, and also are bent at intervals to form spaces for the reception of flat transverse pieces. The latter are interlaced with the springs at regular intervals, are parallel to each other, and secured by fastenings, if desired. The flat pieces give a smooth face to the seat or back of a chair but others of a different shape may be employed to prevent the projection of the corrugations from being unpleasant to the sitter.

Stop Mechanism for Spinning and Doubling Machines.

George Kraink, Paterson, N. J., assignor to himself and John Francon same place.—The first part of this invention consists of the bolster projecting below the bolster rail, and having the loose pulley of the spindle on it, so that the spindle will be freed from the friction of the pulley when the belt is running on it, and thus will always stop when the belt is thrown off. The second part consists of mechanism such that, when a thread breaks and one of the faller wires falls, it will swing a tongue forward into the path of a projection on a reciprocating bar. The tongue will thus be moved powerfully by the latter, so as to release the trip rod to stop the machine. The third part of the invention consists of a piece of cloth or other substance, and a slide with wedge-like prongs, combined with the bobbin on which the thread winds from the spindle, the friction roller which turns the bobbin, and the falling rod by which the spindle belts are thrown off when a thread breaks, so that, when the rod falls, the cloth and the wedges will be moved forward between the bobbin and the friction roller. The cloth then stops the bobbin, so that it will not continue to draw the thread from the spindles after they are stopped. The wedges go under the journals or pivots of the bobbin to lift it, so that it will not press the cloth on the friction roller during the stoppage, and thus protect it as much as possible from wear by the roller.

Improved Spool Box.

Benjamin F. Carpenter, Roselle, N. J.—A stand is rigidly attached to the bottom of a rotary spool box. The thread from the spools, of which there are a number disposed on pivots on the bottom of the box, is carried up through a disk plate level with the top of the cover. The holes in this disk are numbered on the top to indicate the number of the thread. There is a wheel formed of plates, around the periphery of which is placed a close spiral wire for holding the thread when it is being cut. The thread, as it is carried up from the plate, is passed between two of the convolutions of the spiral, and is compressed sufficiently to hold it for cutting. The cutter is semicircular in form, and is attached to the top of the wheel disk, at its ends, and is covered by a spiral. The thread is carried over the latter and forced down between two of the convolutions on the edge of the cutter, and is thus readily severed. In thus cutting the thread, the fingers of the operator are protected by the spiral.

Improved Check Valve.

Marshall T. Davidson, Brooklyn, N. Y.—This invention consists in the combination of a globe-shaped elbow having a horizontal valve seat, with a screw cup arranged vertically above the seat, with a ring-shaped extension for guiding the valve in a vertical direction. The globe-shaped elbow forms an annular chamber around the cup-shaped seat, through which the steam or water is easily conducted to the exit pipe, their return being checked in an effective manner by their vertical downward pressure exerted on the valve, securing it more tightly in its seat. The valve works thus easily in both directions, and forms, by its position at the elbow joint of the pipes, a convenient and efficient connection.

Improved Dress Protector.

Edward G. Kelley, Brooklyn, N. Y.—This invention consists of a dress protector of spiral wire, bent in such shape as is found most convenient for attachment and protection, and attached either directly to the trail of the dress or to a piece of cloth to be applied to the dress.

Improved Ice-Snow Scraper.

Henry Little, Middletown, N. Y.—This is a machine for scraping the snow from the surface of ice, preparatory to sawing and harvesting it. The two side boards of the machine are of such dimensions as will enable them to contain enough snow for a load. Their rear ends meet at an angle. To the lower part of one of the side boards is attached a bar, the rear end of which projects, and has an eye formed in it to receive the pintle formed upon the rear end of a lever, which is pivoted to the other of the side boards. To the inner side of the rear ends of the side boards are attached two vertical bars, the upper ends of which project above the upper edges of said side boards, and are hinged to each other, so that the lower parts of the said ends may spread apart to discharge collected snow. The forward ends of the side boards are connected and held at the proper distance apart by a rod, and the boards are kept from spreading too far apart by stop bars. There is a platform for the driver to stand upon, the ends of which pass through keepers attached to the upper edges of the side boards, so that the said platform will not interfere with the proper operation of the said side boards. In using the scraper, it is drawn to the place whence the snow is to be scraped; the side boards are then brought into a vertical position; the lever and bar are connected together; and the scraper is drawn to the place where the snow is to be deposited. The lever is then operated to disconnect it from the bar and discharge the collected snow, and the scraper is drawn back for another load.

Improved Binders' Attachment for Harvesters.

Wesley C. Dentler, Palmyra, Neb.—This invention is an improved bundle-carrying attachment for harvesters for receiving the bundles when bound, and enabling them to be dropped together when a sufficient number has been collected. To curved braces are pivoted the carriers, the inner ends of which are bent upward to rest against the edges of the tables, and the outer ends are similarly curved to prevent the bundles placed upon them from slipping off. The carriers are connected with cranks formed upon the ends of a shaft. To the latter is attached an arm, the end of which is bent at right angles to be caught by a spring catch, to hold the carriers in place when raised into position to receive the bundles. The spring catch is so formed that one of the binders, with his foot, can readily detach it, and allow the carriers to be lowered by the weight of the bundles, which bundles then slide off. A curved spring is so arranged with the arm as to raise the carriers into position to receive the bundles, when the arm is caught and held by the spring catch, locking the carriers in position. By this construction the bundles can be dropped in rows, so that they can be readily shocked, and so that the shocks can be more conveniently and quickly loaded upon a wagon. This construction also prevents the waste of grain from scattering, and from its being shelled out by throwing the bundles upon the ground as they are bound.

Improved Cattle Stanchion.

Hosea Willard, Vergennes, Vt.—There is a pivoted revolving frame, consisting of two stanchions connected together by horizontal pieces. One stanchion is movable in a slot, so as to admit the head of the animal, and is longer than the other, so that it may be slipped into slots in the cap to make the frame fast. At other times the frame is allowed to revolve in either direction, according to the position of the animal.

Improved Saw Jointer.

Edwin Gowdy, Pettisville, Ohio.—This invention is an improved machine for dressing and truing the teeth of circular and other saws. It consists of a base piece, with a longitudinal screw for carrying a file holder with files firmly secured by a key and washer. After the teeth of the saw have been swaged, and the shorter teeth raised sufficiently to strike the first file, the file holder is adjusted on the saw so that the same runs steadily between end screws. By turning, then, the saw backward, the first file acts as a gage and files on the circumferential edge of the teeth, dressing them smoothly and evenly. The key is then loosened and taken out with the front file and washer. The file holder is then screwed forward and the side files adjusted to the saw, which is then passed several times along the same until the rough side edge of the teeth is taken off, and a smooth and square edge is produced. The file holder is then carried back, requiring, after being once set, but little adjustment, which is, however, easily obtained by detaching the sliding file holder and adjusting the bottom set screws.

Improved Three Cylinder Engine.

Philip T. Brownell, Elmira, N. Y.—This invention is an improved bushing for the crank pin of a three-cylinder engine, and an improved oiling device for the same. The sectional bush for the wrist or crank pin of the engine is cut longitudinally into four equal parts, which are arranged around the pin within the eyes of radial sliding rods, and are secured to said eyes, one to each, in such positions as to give the proper bearing upon the pin. The inner surfaces of the eyes are so formed as to permit a free movement over the parts of the bush that are fastened to the other eyes. The shaft has a disk attached to its inner end, and the wrist pin projects therefrom in a plane eccentric, but parallel to said shaft. Thus at each revolution the pin describes a circle, whose center is the axis of the shaft. The oil for lubricating the bushings is held in and supplied from a cup which is attached fixedly to the pin, but is arranged eccentrically thereto, and concentrically with the shaft. When the engine is at rest, the oil remains in the lower portion of the cup. When in motion, the oil is distributed in the cup and carried around by centrifugal force, finding its way to the bearings.

Improved Mud Fender for Equestrians.

Austin P. Speed, Louisville, Ky.—This is a device for protecting the boots and legs of persons riding upon horseback from being spattered with mud. It consists in a steel frame, to which is attached a boot of such size as to receive the foot of the rider, and within which the stirrup hangs free. The boot consists of a sole having an upwardly projecting flange attached to it, except at one side, which is left open, and the upper edge of its closed side is attached to the covered frame.

Improved Ear Cleaner.

Moritz Leiner, New York city.—This invention is an instrument for cleaning the ear, and it consists in a twisted stem of metal, having a swab or bulb of some soft elastic substance at one end, attached by an eye in one end of the stem, and a spoon or scraper at the other end of the stem.

Improved Seed Planter.

Thompson Pressly, Sweet Home, Tex., assignor of one half his right to D. E. Hicks.—The roller, which runs upon the ground and presses the earth on the seed, is supported by curved side bars and straps, which are adjustable on the beam and standard, so as to throw the roller up or down. The friction of the roller on the ground rotates the agitator in the seed box. The plow is attached to the end of the standard, so that it can be raised or lowered, and thereby regulate the depth of furrow.

Improved Neck Tie.

Reginald R. Parker, Indianapolis, Ind.—The object of this invention is to furnished an improved neck tie or bow, the ends of which are stiffened in such a manner that they are prevented from becoming limp, or wrinkled or curled to the outside, protecting, also, the raw edge, and imparting to the whole bow a neater and better shape. The invention consists in a neck tie or bow provided at the under side of the corners with protecting and stiffening facings, of paper or other suitable material.

Improved Sweep for Cultivators and Plows.

Elias Haiman, Columbus, Ga.—The middle part of the sweep has a ridge formed along its central line and extending from the bolt hole in the stem to, or nearly to, the point, while the side edges of the stem are bent to form flanges extending along the upper edges of the wings. These two corrugations, being thus relatively placed, prevent the sheet from being bent in either a vertical or horizontal direction, and allow of the employment of thin metal that is more easily worked and makes a cheaper article.

Improved Safety Pin for Thill Couplings.

Joseph G. Dance, Long Green, Md.—This invention relates to a peculiar construction of safety pin by which a thill may be coupled to a vehicle with great facility, and yet so securely that no jolting or ordinary casualty will displace it.

Improved Ship.

A. John Bell, Ashland, Ky.—This invention consists in a ship or vessel having its lower deck made in three parts, the middle one resting upon bulkheads bracing the sides of hull, and easily removable.

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Emerson's Patent Inserted Toothed Saws, nd Saw Swage. See occasional advertisement on outde page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

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Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Circular Saw Table.—See Havens' advertisement, page 220.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 20 Platt St., New York.

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All Fruit-can Tools, Ferracute, Bridgeton, N.J.

Attention is called to the Engraving in the present No., of my improvement in Turbines, patented 9th Sept., 1873, No. 142,628. Would be glad to receive offers of purchase for a portion or whole interest in Patent, or for any part or whole or U.S., except N. C., Wis., and Oregon. Offers respectfully solicited. Address Inventor, A. A. Herriman, Dickey House, Dayton, Ohio, until 1st April; after that, Owen Sound, Ontario, until further instructions.

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G. McK. does not state the materials of which his dried varnish consists.—A. S. will find a recipe for dressing skins in the Indian manner on p. 266, vol. 26.—C. H. B. is informed that iron gas pipe is not 5 per cent of the total iron manufacture.—B. B. S. will find full directions for solder of all kinds on p. 251, vol. 28.—C. L. N. will find the directions on p. 7, vol. 30, for constructing a telescope, trustworthy and correct.—J. D. H. will find instructions for skeletonizing leaves on p. 313, vol. 29. Suggestions for preventing echoes in buildings are given on p. 356, vol. 29.—J. N. F. will find some valuable information on the restoration of burnt iron on p. 51, vol. 30.—E. H. B. The attraction of gravitation is the attraction of all portions of matter for each other.—A. O. W. The prismatic colors are often visible in a halo, or in a fog of any kind. There is no generally accepted theory of the aurora borealis. Meteors are supposed to be small portions of matter floating through space; they are attracted to our center of gravity, and become incandescent by friction with our atmosphere.—A. F. B. will find that a marine glue, made of best glue and caoutchouc, will remain flexible if enough caoutchouc be used.—J. W. B., of Nashville, Tenn., does not send his name.—L. M. should apply to the master mechanic of some railroad for a situation as fireman.—W. C. T. will find directions for building cement walls on this page.—M. H. W. can fasten leather to iron by following the directions on p. 42, vol. 26. Cementing emery to cloth, leather, and wood, is described on p. 266, vol. 26.—W. A. R. can cast rubber by the process detailed on p. 283, vol. 29.—L. B.'s questions are incomprehensible.—F. L. S. can find the proportions of acids for silvering glass by experiment. We have never heard of any successful mode of silvering glass by electro-deposition.—A. B. D. will find directions for mounting and varnishing chromos on p. 154, vol. 27. For picture frame filling, see p. 90, vol. 29.—C. W. H. Jr. can attach cloth to cast iron by the process described on p. 42, vol. 26.—H. E. cannot do harm by having an investigation of his engine.—D. W. G. will find a bar or chisel handy for knocking clinkers from the sides of a stove.—J. A. will find directions for transferring engravings on p. 138, vol. 30. Chinese white or the mineral off an enameled card will do to whiten the surface of the block.—W. K. should read Wilson's "Treatise on the Steam Boiler."—G. F. D. can clean his old files by the process described on p. 263, vol. 28.—G. McI. can utilize his old rubber by following the directions on p. 349, vol. 26.—B. J. L. should read the instructions on p. 379, vol. 26, for polishing walnut wood.—W. F. will find directions for mending rubber boots on p. 208, vol. 30.

A. A. says: In the SCIENTIFIC AMERICAN of August 16, 1873 (editorial on lightning rods), it is stated that the gas and water pipes ought to be connected with the rod; because if not, there is danger that persons may receive shocks from such pipes by the induced electricity developed in them. Now, as the rod and the pipes all extend into the ground, are they not all substantially connected? If the water and gas pipes of a dwelling communicate with the ground, and through it with the rod, is any further connection necessary in order to prevent injury by induced electricity? A. The connection with the ground is good, but at the wrong end. The upper ends must be connected or the resistance of the pipes etc., themselves will cause the trouble mentioned; and also as regards the induction, this is an action in which the end of the rod nearest the cloud is charged and not the other end in the ground. These are a few points, but one must study the meaning of induction, resistance, tension or "potential," etc., to see the whole thing clearly.

B. B. E. asks: What shape or degree of convexity must a plano-convex lens have to ensure the least spherical aberration? A. The smallest curvature possible, in other words, a long focus lens.

C. R. asks: How much power is saved by the use of sperm oil for lubricating purposes as compared with lard, tallow, or mixed oils? A. There will be from 1 to 5 per cent of difference in the friction with different lubricants, according to Morin's experiments.

T. M. Jr. asks: 1. Do you know of any make of engines with the ordinary eccentric valve cutting off at both ends of the stroke alike? What would be the advantage of such an arrangement? A. It is sometimes done by making the lead different at each end of the stroke. 2. What could I do to prevent danger to surrounding buildings from sparks coming out of the stack of a cupola while casting? A. We cannot recommend any very reliable preventive.

A. P. G. asks: Has any steam frigate, of any sea-going vessel of any class, ever attained a speed of 25 miles an hour, under ordinary conditions? A. We have seen it stated that one of the English blockade runners, during the war, made a speed of 22 miles an hour; but this is not well authenticated.

S. says: Is smoking cigarettes very injurious, on account of the paper in which the tobacco is wrapped? A. The paper is injurious, but not more so than the vile weed it encloses.

F. G. W. asks: How heavy a weight with a fall of 20 feet will it require to run a sewing machine, on ordinary work, for an hour? A. A weight of 3,000 lbs.

H. R. G. says: I would like to mold some rubber blocks. How shall I dissolve my rubber? Would plaster of Paris do for molds? A. Dissolve in bisulphide of carbon. Plaster of Paris will answer for molds.

G. W. F. says, in reply to M, who asks what causes his pump valves to thump: "I set up an engine running at 150 revolutions with a pump which thumped. I put a bolt with a large head up through the air chamber and screwed it down over the valve, not letting the valve lift so high. Then I put a jam nut on top to keep it from turning, putting rubber between nut and air chamber, to make it tight. The head of the bolt, coming close to the valve, keeps it from lifting too high. It has worked all right ever since. [We are much obliged to our correspondent for this letter. Our readers would do good service if they would send us notes of this kind on matters of general interest.—EDS.

W. B. asks: What effect will frost or rain have on a wall made of water, lime, sand, and clay? How should these ingredients be mixed? How should water, lime, sand, and small limestone be mixed to make a wall? How would water, lime, sand, and soft coal cinders do for a wall? A. To build concrete walls it is not safe to use anything but the best cement, broken stone, gravel, and clean sharp sand. One barrel of the best Portland cement will be sufficient for 13 barrels of the other ingredients, filling the interstices between the particles of stone and gravel and adding nothing to their bulk. The cement should be well incorporated with the other ingredients, and supplied with sufficient water to set well.

F. H. B. asks: What is the advantage of constructing shot guns of laminated steel or twist iron barrels? Two old hunters here claim that a shot gun barrel made of pewter on any other material would throw shot just as well as guns of the best made steel, if they were subjected to the same charges of powder, and say that the material of which they are made makes no difference in the shooting. A. Provided the shape of the barrel is not changed by the discharge, we think the old hunters are right. It is not difficult to see, however, that a much lighter construction can be secured, with the same strength, by making the barrels of tough iron.

E. F. C. asks: 1. In constructing an induction coil, how many thicknesses or layers of wire should there be in the primary coil, and why should it be composed of coarser wire than the secondary? A. From one layer upward, although there is but a slight gain beyond a certain point. It is made of coarser wire in order to afford less resistance to the electric current. 2. How is the secondary coil to be wound? Should it be done by commencing at one end of the wire, and winding it upon the primary coil, as thread is wound upon a spool? A. It is best to wind it on flat layers like the coils of a rope, and insulate each layer from the next by a ring of oiled silk or other insulator. 3. How many cups of Daniell's battery, 8 inches high by 6 inches diameter, would be required to run the coil described on p. 316, vol. 29, so as to produce perceptible shocks? A. Six cups of Daniell's battery, with a properly constructed coil, should give sparks several inches in length.

J. H. D. says: 1. I am running an engine of about 75 horse power, an ordinary horizontal with common slide valve. I wish to reverse the motion or speed; how can I best do it, as I cannot very well get access to the valve? An engineer gives me the following rule: "Place the crank in position answering to the end of the stroke, and mark the valve stem with file or chisel close up to the gland of stuffing box; now place the crank on the opposite center, loosen the eccentric and turn it round upon the shaft until the mark on the valve stem comes out to the edge of the gland, and fasten the eccentric." Is this a correct rule, and will it give the same lead as before? It does not seem to me that it would. A. It would not give the same lead; and if you do not know the amount, you may have to equalize it by trial at the cylinder cocks. 2. On p. 331 of your vol. 29, in answer to F. H. D.'s query as to the proper dimensions of steam and exhaust pipes, you give a table taken from W. S. Auchincloss' work on valve and link motion. What I wish to know is how to use the table; I cannot exactly see into it. Will you please make it a little clearer for me and several others? A. The piston speed in feet per minute is twice the number of revolutions per minute multiplied by the length of the crank in feet. For example, an engine having a diameter of 16 inches and a stroke of 2 feet, making 100 revolutions per minute, has a piston speed of $2\times100\times2=400$ feet per minute. The area of the piston is 201 square inches, and from the table it appears that the area of steam pipe should be $201\times0{\cdot}058=10{\cdot}653$ square inches, which corresponds to a diameter of a little more than $3\frac{1}{4}$ inches.

O. C. W. says: I have a pipe 3 inches inside diameter and 20 feet long, standing erect with closed valve at the bottom. It is filled with water. What is the pressure on the valve? A. The weight of the water, if the valve has the same diameter as the pipe. 2. How can I increase the pressure without making the pipe longer or forcing the water in at the top of the pipe? A. By dissolving something in the water, to make it heavier.

L. W. asks: Will a rotary engine of 3 horse power propel a small side wheel boat 30 feet long by 7½ feet beam? It draws 12 inches of water. The boat has a medium flat bottom and is sharp forward. Her engine runs at 300 revolutions per minute, and is geared to wheel shaft in proportion of 4 to 1. What speed ought to be obtained, the diameter of wheel being 5 feet 6 inches, with 8x10 buckets? A. With such an engine, the speed would probably not exceed 2½ miles an hour.

H. G. C. says: Has the twist or rotary motion, given to a rifle ball by the pitch of the rifling, anything to do with its velocity or the distance to which it may be thrown by a given charge of powder? A. The twist diminishes the velocity.

C. Y. says: Please state what is the size of the quantity galvanic battery necessary to heat an iron wire the 1-25th of an inch in diameter to red or white heat? The liquids are to be nitric and sulphuric acids. A. About twenty cells.

N. D. S. asks: Is there a law that will hinder me from putting a steam saw mill on a boat and running it (by steam) to any place? I am not a licensed engineer. Can any inspector force me to have my boiler tested against my will, if I only carry my own property? A. We do not think that your case will fall under the requirements of the steamboat law.

M. W. R. asks: How can I restore the color of a black silk velvet cloak that had lime water on it, turning it to a light brown? A. Further injury may be prevented by rubbing the spot first with dilute acetic acid and then with water, but the coloring matter has been destroyed and can be restored only by dyeing again.

A. S. G. says: A stream of water moves at the rate of 10 miles an hour, with a fall of 1 foot per mile; what is the momentum of the water per square foot? A. The horse power of the water per square foot of cross section is equal to the velocity of the water in feet per second multiplied by 62·4 times the hight due to this velocity, and divided by 550. To illustrate: Velocity in feet per second = 14·6. Hight due to this velocity $(14{\cdot}6)^2 \div 64{\cdot}4 = 3{\cdot}3$ feet. Horse power of water per square foot of cross section, $\frac{14{\cdot}6\times3{\cdot}3\times62{\cdot}4}{550} = 5{\cdot}3$ nearly.

S. C. Z. asks: 1. At what part in a machine is it that the dead point most frequently occurs? A. It is the position of the crank when the piston is at either end of the stroke. 2. Can you tell me of any chemical that will dissolve mica? A. Most varieties are decomposed by sulphuric or hydrochloric acid. The silica can then be dissolved in hydrofluoric acid, or a solution of caustic alkali.

P. says: A neighbor bought a cast steel plow and put it into gravelly soil. After using it half a day, he found the mold board badly creased and furrowed. He then exchanged the steel plow for a cast iron one. It is well known that a steel sleigh shoe sticks worse on bare ground than a cast iron shoe. Is steel softer than iron? If not, how do you account for these facts? A. This may be explained on the supposition that the steel was of poor quality and badly tempered, so that it was not homogeneous in texture, and did not have the same degree of hardness throughout.

G. O. A. asks: Will a solid ball of iron weighing 25 lbs. fall a distance of 1,000 feet quicker than a ball of the same description weighing 1 lb.? A. No. 2. Will a cylinder of iron 1 inch in diameter and 12 inches long fall 1,000 feet quicker than a cylinder 1 inch in diameter and 1 inch long, if dropped end foremost? A. No.

S. says: We have a tubular boiler running night and day, using water pumped from the river, without any filtering. We find, after running three or four days, that the water foams in the boiler to such an extent that we are compelled to let the steam go down and draw off part of the water, and refill with fresh. Can you give me through the columns of your paper any method to prevent foaming? Is the use of tallow or any other oily substance injurious to a boiler? We have in use an upright boiler feeder, and until recently have used the exhaust from the pump to assist in heating water for the boiler, the pump piston being lubricated by tallow. The question has arisen whether the tallow used would materially affect the boiler or in any way have a tendency to cause foam by entering into a combination with matter contained in the water. A. The foaming seems to be caused by impurities in the water, which raise the boiling point. Blowing off a portion of the water at intervals may remedy the trouble, but it would be better to use a feed water heater that would extract the impurities. Oil and tallow will do no harm, unless they contain impurities.

J. E. C. asks: I. Will it increase the draft of a portable engine when not in motion to connect a small pipe with the boiler and let it extend into the smoke stack? A. Yes. 2. If so, what sized pipe should I use for a 12 horse power engine, and how far up in the smoke stack should it extend? A. About a quarter of an inch in diameter. Run it up three or four feet.

L. E. I. asks: 1. What are the proper dimensions for the ports of a cylinder 4½x6 inches, running 250 revolutions at 60 lbs. pressure? A. Make the port area one half that of the piston. 2. What would be the power of such an engine? A. Horse power equals pressure on piston in pounds multiplied by piston speed in feet per minute, divided by 33,000.

J. G. G. G. R. says: 1. I sit opposite a large stained glass window in church. I am shortsighted and cannot, with my eyes wide open, see the shape of the figures, but if I close them a little, every little line, etc., stands out very clearly. Why is this? A. Shortsightedness is owing to a too great convexity of the eye, the rays of light coming to a focus before reaching the retina. The muscular action of nearly closing your eyes may have the effect of flattening the humors of the eye sufficiently for distinct vision, and of also cutting off extraneous rays of light, like the stop or diaphragm used in the telescope. 2. I have not a heavy voice, but when I get up in the morning it is a deep bass. This continues for about an hour, and then it resumes its natural tone. How is this? A. It looks as if your voice were not inclined to rise until an hour after its owner. You had better consult a physician, as this may be owing to some slight bronchial or throat complaint. 3. Would a device for preventing an engine from getting on a center pay? A. Such a device might in some circumstances be an improvement. 5. Is there any method by which a person could copy music faster than with a pen, something in the way of types, etc.? A. An instrument has been invented by which, it is said, in the act of playing the piano, the composer's musical thoughts are at once printed by types on a piece of paper. The keys actuate machinery which is put in motion by electricity. 5. Is there any method by which a shortsighted person could restore his sight to its original quality? A. The only remedy we know of for shortsightedness is to wear spectacles of the proper curvature.

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M. J. C. asks: How is steel wire tempered for making springs, and how can the temper be taken out of steel wire so that it will not break? What is the best way of tempering steel tools? A. Steel is tempered by being heated and then suddenly cooled in water or oil. The temper can be drawn out by heating the steel, and allowing it to cool slowly.

S. L. B. says: In your issue of February 14, M.M. asks: "If I hang a rope over a loose pulley and put my feet in a loop in one end and take the other in my hands to elevate myself, what proportion of my weight do I pull down with my hands? My friend says I have no advantage over a single rope, I say I gain nearly half. Which is right?" Suppose M. M.'s feet are in the loop and his hands on the other end of the rope, there is obviously the same weight on each end of the rope, for if one end were more heavily loaded than the other it would of course (after overcoming the friction of the pulley) draw the lighter end over the pulley. M. M.'s weight then must be just evenly balanced between the two ends. If he weighs 200 lbs., then each end of the rope supports just 100 lbs. To support himself then he must pull down with his hands just 100 lbs., and to raise himself he must pull enough more than 100 lbs. to overcome the friction and leave a slight excess of weight on his hands. Of course with a single rope he would pull the whole 200 lbs., and, equally of course, by the pulley and loop, etc., would gain, as stated, nearly one half his weight. A. It is a settled fact in philosophy that power is indestructible, and can neither be created nor destroyed by man. This being so, there can be no gain of power by the man, whatever arrangement he uses to elevate himself, the work done being the weight raised multiplied by the distance through which it was lifted. In the case of the loose pulley, if the man raises himself with half the force required where a single rope is used, he exerts the force through twice the distance that would be necessary in the case of the single rope. Moreover, there is some additional work required, on account of the friction of the pulley and the rigidity of the cordage. Notwithstanding this, it may be a convenience to use the loose pulley, for the same reason that other mechanical devices are frequently employed.

J. F. F. asks: What is the difference between a 3 foot wheel with 4 discharges, that will use 300 inches of water under 8 feet head, set in a flume, and one of 4 feet diameter with 8 buckets, with scroll on top of wheel, using same amount of water? Will the one in the flume run any faster than the other, if both wheels are of the same size? A. This is a matter that can best be determined by experiment.

G. B. asks: 1. How many barrels of cement will it take to build a house 60 feet long, 23 feet wide, and 25 feet high, the walls to be as thick as they ought to be in your judgment? A. The thickness of the walls should be adjusted to suit the length of the wall as well as the hight, independent of the weight of floors, etc., which they will have to support. If you have a cross wall at the center of your building, and the concrete be properly made, the walls may be 12 inches thick, for an ordinary load on the floors, etc.; but without the cross-wall, 16 inches would be little enough for their thickness. The concrete should be composed of one barrel of Portland cement to 13 barrels of broken stone, gravel, and clean sharp sand; the proportion of cement therefore, is equal to one thirteenth of the entire wall —for it is lost in the interstices of the stone and gravel. If 25 feet of hight includes the foundation (which should extend at least 4 feet deep into the ground if you have no cellar), then your wall, if 12 inches thick, will contain 4,050 cubic feet, but if 16 inches thick will contain 5,400 cubic feet; one thirteenth of these amounts is 311 7/13 and 415½ respectively. A barrel of cement when slacked will make about 4 cubic feet; the 12 inch wall, therefore, will take 78 barrels, and the 16 inch wall 104 barrels. 2. Is common mortar as good as cement for building concrete houses? A. No; it is the most economical to use the best cement.

F. O. C. H. asks: How can a patch be put on a boiler with bolts, so as not to leak? We have tried lead, iron, and hemp with white lead, but neither would do. A. It should have a lip turned all around it, so that a good quantity of cement may be introduced. The cement should be made of red and white lead and iron borings, and should be very stiff.

P. D. F.—1. A siphon can only operate when its discharge orifice is lower than the level of its supply. 2. The lantern for showing paper pictures instead of glass transparencies, is constructed like any magic lantern, but the picture is placed where the light usually stands, and the light is placed at one side, so as to illuminate the picture. To work well a very strong light is required. The mineral specimen looks like a fossil plum. The width of the Gulf Stream is about 50 miles.

D. G. says: 1. Can the insulators ordinarily used on wires be coated, with lead, tin, or some other material that will protect the insulating material from decay? A. They can be coated with gutta percha. 2. What is "static induction"? A. The influence of an electrified body upon a body which is not in contact with it. 3. If copper is a better conductor than iron, is it necessary that a telegraph wire made of copper should be as large as one made of iron? A. No. 4. What size is the smallest copper wire which is sufficiently large for ordinary telegraphing, tension not considered? A. It will depend upon the current. It is only necessary that it should be large enough not to become unduly heated. 5. In your paper of January 31, p. 71, the writer on sumac speaks of an acre producing not less than three tuns; does he mean green sumac or dry? A. Dry. 6. How can I obtain the Commissioner's report spoken of there? A. Write to the Commissioner of Agriculture, Washington, D. C.

M. J. C. asks: I. How is brass wire tempered for making springs? A. By hammering or rolling. 2. Is there any way of hardening brass so that it cannot be filed? A. We do not know of any method.

M. J. C. asks: 1. How can cast iron be soldered? A. By first tinning it. 2. How is cast iron hardened so that it cannot be filed? A. By chilling it in the mold. 3. Can cast iron be welded? A. No.

C. W. K. asks: 1. What are the improvements needed in rotary engines? A. Some means of preventing wear. 2. Is the unequal balance in the revolving cylinder a serious objection? A. This is obviated in some forms. 3. As there can be no shock in this style of engine, would you consider a variable cut-off of any use? A. It will be useful in cases where the load is variable.

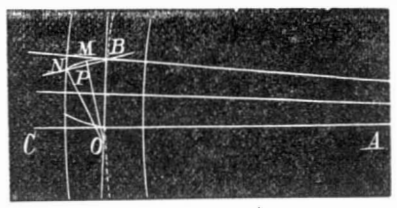
W. W. McK. asks: What is the best to do with cast iron borings? Can I melt them in a cupola? Will not the fan or blast blow them out? How would it do to put a small portion in each ladle of hot iron? Do you think they would melt sufficiently to make a good sound casting? A. Your best plan will be to melt m first in a crucible.

G. P. H. asks: Is there any invention used for the purpose of detecting mineral substances in the earth, as, for instance, silver? A. No.

W. F. W. says: When we speak of the power of the lever, three things are to be understood, the power applied, the resistance, and the fulcrum. Some people believe that a large water wheel is more powerful than a small one for the same reason that a long lever is better than a short one. In two overshot or breast wheels, one 10 and the other 20 feet in diameter, with buckets of equal size holding 200 lbs. water each, the segment to be on or near the outside of the wheel, with pinion attached on a level with wheel shaft, the power and resistance will be at the same point. Where is the fulcrum? Now suppose it takes 200 lbs. water (1 bucketful) to start the machinery. If one bucket, at the pinion on the small wheel, be filled with water, the machinery will start. Will any less weight of water start the machinery on the large wheel? A. You refer, as we understand you, to the supposed gain of power by the use of a long lever. This, of course, is a delusion. What the long lever accomplishes is to make a little force available; and in this way it is sometimes a convenience.

S. G. C. says: Your answer to W. F. W., February 28, as to the lever principle applied to the overshot water wheel may be correct if only applied to the turning of the wheel; but when the power of the wheel is applied to the driving of machinery, I assert that there is no lever principle applicable. One whee will start just as much machinery as the other, but the larger wheel will continue the power twice as long as the smaller wheel, for the reason that the water would remain twice as long on the larger wheel. I claim that the power of an overshot water wheel, when applied to driving machinery, is just the weight of the water it contains less the friction, without any advantage of lever purchase. Am I right? A. You have the correct idea on the subject. No well informed person imagines that there can be any gain of power by the use of a lever or other mechanical device. The object of the mechanical device is to make the power available.

F. L. L. asks: How can I draw the curves on teeth of gears? I send you a copy of a drawing from Armengaud's "Practical Draftsman's Book," but I do not understand it. His rule is: As draftsmen are generally satisfied with representing the epicycloidal curves by arcs of circles, which almost coincide with them and nearly fulfil the same conditions, such arcs must be tangential to the radial sides of the teeth at their points of intersection with the pitch circle. They are determined in the following manner: Through the point of contact B, draw a tangent, B O, to the pitch circle; then bisect



the chord, B N, which passes through the extremities of the curve by a perpendicular, which will cut the tangent, B O, in the point, O. This is the center of the arc, B M N, which very nearly coincides with the epicycloidal curve. The same arc is repeated for each side of all the teeth of the pinion, the radius, B O, being preserved throughout. How can I find the point, O, and how can I draw the chord, B N? If the point, O, is known, what is the use of drawing the chord, B N, and how far from the point of contact should the point O be? A. The points B and N are given. Connect them by a straight line. Draw P O perpendicular to B N at its middle part, and mark the point, O, in which it cuts the tangent. Draw the arc, B M N, with the radius O B or O N.

H. H. C. says: A friend of mine says that powder can be exploded in an ordinary gun, with an ordinary charge, without report, by oiling the barrel tube and cap. I think not. Which is right? A. It is best to settle so simple a matter by direct experiment.

T. L. asks: How can I set a locomotive eccentric which has slipped? A. It can be done by trial, placing the engine at each end of the stroke, and trying the cylinder cocks.

J. P. asks: How can I season a wooden screw made of green hardwood timber, so that it will not crack in seasoning? A. Your best plan will be to place it in some position so that it will become seasoned very slowly; but even with this precaution, it is doubtful if you can prevent cracking.

P. H. B. asks: 1. How can I make a calcium light for an experiment? A. A cheap modification may be made by forcing a current of air, by means of a blowpipe, into a flame of common illuminating gas, and directing the flame against a piece of chalk. You do not send sufficient *data* as to your other query.

G. A. asks: I. In spinning copper, how is the work fastened in the lathe? A. With a clamp. 2. Should metal or wood tools be used? A. Very hard material is necessary for the tool. 3. Which is the best wood for models? A. Mahogany.

A. N. R. asks: Is there any instrument for enlarging or contracting drawings? A. Yes. See engraving and directions for use and manufacture in *Science Record* for 1874.

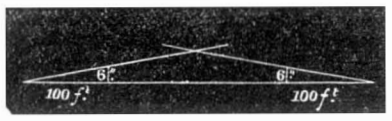
C. & P. ask: Can you give us a recipe for hardening cast steel mold boards of plows? We harden with prussiate of potash, sal ammoniac, and black oxide of manganese, but these, we find, only harden on the surface. A. You should harden the steel by the ordinary processes of tempering, which have been of late frequently described in our columns. A few experiments will show you the best heat.

A. H. D. asks: How many feet board measure are there in a scantling 2½ inches square at one end, and 3½ inches square at the other, and 11 feet in length? A. The ordinary rule of finding the contents, in board measure, of a piece of timber, is to multiply the breadth in inches by the depth in inches, and by the length in feet, and divide the product by 12. Where the timber tapers regularly, the center breadth and depth are used. In the given case, the piece of timber is the same as one having a breadth and depth of (26+38)÷2=32. Hence the contents in board measure will be (32×32×11)÷12=938·6+

G. W. A. asks: How do you calculate the number of square inches of a safety valve, and how large should the pea be? A. The following formula will enable you to determine any part of a safety valve, if you know the others: Pressure of steam in pounds per square inch × area of the valve in square inches × lever arm of valve = weight of ball × lever arm of ball + weight of lever × lever arm of lever + weight of valve and stem × lever arm of valve

P. T. B. says that an experience of 24 hours will convince C. R. M. that his potato vines would all be dead, if arsenic were used instead of Paris green.

R. A. B. says, in reply to E. B. who asked by what means was accurate alignment of the Hoosac tunnel attained: "I can answer this, as I did it myself. In the first place, a line was run over the mountain and tested several times to see that it was exactly straight. Then the working lines of the tunnel diverged northerly



six inches in every one hundred feet from each end This was to prevent the possibility of passing in the center without meeting."

H. M. P. says that G. S. D., who gives a method for finding the weight of a person's head without cutting it off, must try again, for two reasons: 1. This method assumes that the body, including the head, is of the same specific gravity as water. 2. It assumes that the head is of the same specific gravity as the rest of the body. The method can easily be tested by an experiment with an india-rubber-headed doll, first weighing with the head filled with air, and then with it filled with shot; but the simplest test of the principle would be to fill one end of a block of wood with lead, and to weigh it with the ends alternately immersed in water. The weight will be found the same, whether the light or the heavy half is above the surface.

J. H. W. says, in reply to many readers, who ask how to make flour paste that will not sour: Take 2 lbs. of flour and 4 pints of water, mix part of the water slowly with the flour, rub up all the lumps, continue to add the remainder of the water till all is added, then strain through a napkin or colender and cook slowly; stir frequently to prevent scorching; when it comes to a boil, take it off. It is sufficiently cold. Then stir in half an ounce of nitro-muriatic acid and put into an earthen vessel to keep. A small piece of alum, the size of a chestnut, broken up and dissolved in the water, has a tendency to whiten the paste. Paste required to be made white should be cooked, if acid is used, in a porcelain vessel. Cooking paste too much has a tendency to destroy its adhesive property.

S. K. W. says, in reply to F. H. M. who asked for the best way to wash flannels: Supposing this inquiry to mean without fulling or turning them yellow, I will give a *modus operandi*, which I have found satisfactory: Shave a little white soap into a pail, and pour on it water nearly boiling hot to dissolve it, adding, if you choose, a tablespoonful of spirits of ammonia. Pour the hot suds upon the flannels in a tub, and use a good pounder or a machine, as the water needs to be of too high a temperature for the hands. Wring the flannels, and put them into a second water, like the first except with less soap, and use again the pounder or machine. Rub the soiled spots in the suds as hot as you can bear; but never rub soap on the spots. Wring the flannels as dry as you can with a good wringer, and put them on a line in a brisk, drying air. The hotter they are when wrung, and the sooner they dry, the better. Their color may be improved by a little bluing; and if they are well ironed before getting quite dry, fulling is prevented.

B. W. says, in reply to M. S. W.'s three questions as to contraction of the horse's hoof: The contraction of the hoof is brought on by cutting the frog, and by ignorance in setting the shoe, by carrying the seating or bevel of the upper side of the shoe so far back that the heel rests on the slope of the seating, otherwise on two inclined planes; so that every step presses the heel together. The frog, having been cut, loses its elasticity and resistance. The heel should rest on a flat surface, and the shoe set flush with outer shell of hoof all round, and the frog should seldom, if ever, be cut. Nature has made ample provision for throwing off all superfluous frog. Contracted hoof operates on no part of the leg above the fetlock joint. The coffin joint is most affected. Your correspondent can experiment on the sensation produced in contracted hoof by putting the feet into a pair of boots that are two sizes too small and three sizes too narrow on the bottoms, and walking 10 miles per day for 30 days, then standing in them all of the next day on a hard floor. This will give him a better idea of what causes the lameness than can be described.

J. W. P. says: 1. I have a quantity of beeswax that has been used for dental purposes; it has become mixed with plaster of Paris, gutta percha, and the dirt from the laboratory. How can I separate the pure wax from the mixture? 2. Can old and brittle gutta percha be made over again, so as to work like new? J. J. J. asks: Is there a compound that will force the beard to grow faster than it will of itself? E. F. G. asks: Is there any way of photographing a positive picture on glass directly, so as to answer for a magic lantern slide? Is there any way of changing a negative into a positive?—A. E. C. asks: Which can be drawn more easily, a large or small axled wagon? Most farmers claim that a wooden axle in a pipe box can be drawn more easily, on bad or rough roads, than an iron axle, because it is larger.—G. J. asks: Can any one give the formula for the enamel used on engineers' instruments, which is called the bronze finish?—A. B. D. asks: In what manner should a common mouth blowpipe be applied to the flame and work to get the best effect in soldering (hard and soft) and in assaying and experimenting with ores and metals?—C. D. M. asks: Does the rapidity in which the temperature of steel is changed have a tendency to detemper it, providing the temperature is not raised above 225° Fah.? For illustration, take a razor at a temperature of 10° and plunge it into boiling water. Will this detemper it to an injurious extent? Does it injure a razor at all to put it into boiling water? What is the *rationale* of the detempering of steel? Is it effected by a rearrangement of molecules, or is it a decarbonization?—W. E. S. asks: Can any one start and stop a 20 horse power engine by telegraph? If so, how? —M. J. M. asks: How are clocks finished, and what kind of varnish is used?—C. L. asks: How can I construct a microscope (with two lenses) strong enough to see distinctly the animalculæ in water? 2. Why is a glass can protected from bursting, when being filled with hot fruit, if a knife or spoon is placed upright in the can?—W. E. S. asks: What is the best and most durable whitewash known, for outdoor work?—N. L. F. asks: If a vessel of water is revolved so that the contents will be elevated at the outside, and a series of endless chains, provided with floats, arranged over pulleys in such a manner that they will ascend at the outside and descend near the center of motion, where the water is considerably lower, will the unequal hight of the columns in which the chains are mersed impart motion to the chains, and if not, why is the buoyant effect o the liquid in this case different from what it is when a rest?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Ball dropped into the Earth, etc. By J. L. B.

On an Aerial Electric Ship. By C. W. W.

On the Hanging Rope and Pulley. By M. M., by C. B. T., and by N. P. M.

On Large and Small Water Wheels. By G. P.

On a Crooked Stick. By A. A. C.

On a Gasoline Accident. By W. L. W.

Also enquiries from the following:

P. A. T.—J. M.—M. P. C.—T. C. H.—G. C. H.—A. H.—J. M. M.—G. B. & P.—H. H.—N. R.—J. T.—H. G. J.—G. & A.

Correspondents in different parts of the country ask Who sells a plow that will scour as well in black prairie land (Texas) as in a sandy soil? Who makes sawing machines for felling trees? Who makes magnets to order? What is the best protector for wood work exposed to the weather? Who makes cork cutting machinery? Who makes machines for packing coffee, etc., in paper? Who makes furnaces for restoring spent alkalies? Who makes twist drills, of different kinds? Who has a patent plan for building lime kilns? Who makes iron slat blinds, suitable for brick-fronted buildings? Who makes portable paper boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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APPLICATION FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

23,633.—MARKING CLOTH.—H. W. Fuller. May 20.

EXTENSIONS GRANTED.

27,357.—TABLE CUTLERY.—J. W. Gardner.
27,392.—FOLDING AND PASTING MACHINE.—G. K. Snow.
27.403.—STEAM AND FIRE REGULATOR.—J. Woodruff.

DESIGNS PATENTED.

7,208 to 7,211.—CARPETS.—T. Barclay, Lowell, Mass.
7,212.—BURIAL CASKET.—F. W. Biele, New York city.
7,213 to 7,221.—CARPETS.—R. R. Campbell, Lowell, Mass
7,222 to 7,224.—CARPETS.—J. Hamer, Lowell, Mass.
7,225.—CARPET.—C. S. Lilley, Lowell, Mass.
7,226.—CARPET.—D. McNair, Lowell, Mass.
7,227 and 7,228.—BIRD CAGE.—G. R. Osborn *et al.*, N.Y. city
7,229 and 7,230.—TYPES.—W. H. Page, Norwich, Conn.
7,231 and 7,232.—RUCHES.—E. C. Wooster, New York city.

TRADE MARKS REGISTERED.

1,651.—HARD SOAP.—Buffalo Soap Co., Buffalo, N. Y.
1,652.—COLORS.—T. Buswell, Solon, Me.
1,653.—SHIRTS.—H. Christensen, Chicago., Ill.
1,654.—LUBRICATING OIL.—Loomis & Co. Pittsburgh, Pa.
1,655.—WELDING COMPOUND.—H. Schierloh, J. City, N.J.
1,656.—WATCHES.—National Watch Co., Elgin, Ill.
1,657.—MEDICAL COMPOUND.—H. A. Tilden, New Lebanon, N. Y.
1,658.—CHEESE.—A. H. Turner, Brooklyn, N. Y.
1,659.—TOBACCO.—Weil & Co., New York city.
1,660.—ALES.—A. W. Wickes. N. Y.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FEBRUARY 24 to MARCH 3, 1874.

3,169.—Wm. C. Shipherd, Cleveland, Cayuhoga county, O., U. S. Improvements on whiffletree stubs, called "Shipherd's Improved Whiffletree Stub." March 5,1874.
3,170.—Wm. McKean, Toronto, York county, Ont. Improvements in meat cutters, called "McKean's Meat Cutter." March 5, 1874.
3,171.—J. W. Meaker, Detroit, Wayne county, Mich., U. S. Improvements in self-closing doors for hatchways, called "Meaker's Self-Closing Doors for Hatchways." March 5, 1874.
3,172.—A. Muhleisen, Ottawa, Putnam county, O., U. S. Improvements on hounds for vehicles, called "Muhleisen's Bent Hounds for Wagons, etc." March 5, 1874.
3,173.—R. C. Margeson, Halifax, Halifax county, N. S. Medicine for cure of the stone, gravel, and other diseases of the urinary organs, called "Calculifuge." March 5, 1874.
3,174.—J. A. Tupper, Ottawa, Carleton county, Ont. Improvements on washing machines," called "Tupper's Washing Machine." March 5, 1874.
3,175.—D. Mack, Barnesville, Bourbon county, Kan., U. S. Improvements on garden cultivating implements, called "Mack's Garden Cultivating Implements." March 5, 1874.
3,176.—G. Casey, Ottawa, Carleton county, Ont. Improvements on a machine for washing clothes, called "Casey's Improved Washer and Wringer." March 5, 1874.
3,177.—G. J. and J. R. Wilson, Ottawa, Carleton county, Ont. Machine for washing clothes, called "Wilson's Common Sense Washer." March 5, 1874.
3,178.—J. A. Knight, Auburn, Androscoggin county, Me., U. S. Improvements on tables, called "Knight's Improved Drawing or Writing Table." March 6, 1874.
3,179.—T. A. Norris and C. Lockman, Hamilton, Wentworth county, Ont. Apparatus for sifting coal cinders without dust. called "Norris & Lockman's Improved Coal Cinder Sifter." March 6, 1874.
3,180.—S. F. Cowles, Coventry, Vermont, U. S. Improvement on apparatus for cooling and preserving milk, called "Cowles's Milk Preserver." March 6, 1874.
3,181.—G. Morton, Orwell, Elgin county, Ont. Improvements on a machine for burnishing photographs, called "Morton's Improved Burnisher." March 6, 1874.
3,182.—S. W. Emery, Portland, Cumberland county, Me., U. S. Improvements on four wheel railway cars, called "Emery's Improved Four Wheel Railway Safety Car." March 6, 1874.
3,183.—W. R. Jolley, North Repps Rectory, Norfolk county, England. Improvements in life rafts, called "Jolley's Life Raft." March 6, 1874.
3,184.—A. MacKay and G. Jones. Montreal, P. Q. Process for preventing and neutralizing sour beer, stout, ale, and other malted liquors, called "MacKay & Jones's Preservative and Neutralizer of Beer, Ale, Stout, and Finings." March 7, 1874.
3,185.—Jas. Morrison, Toronto, Ont.—Improvements on check valves, called "Morrison's Combined Adjustable Check and Globe Valve." March 7, 1874.
3,186.—Jas. Morrison, Toronto, Ont. Improvements on water gages for steam boilers, called "Morrison's Improved Adjustable Water Gage for Steam Boilers." March 7, 1874.

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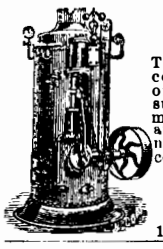

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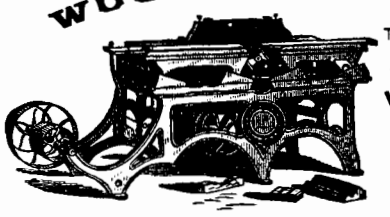

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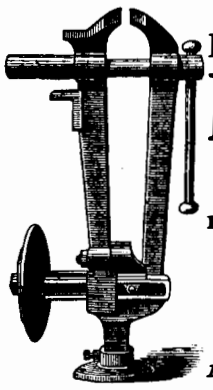

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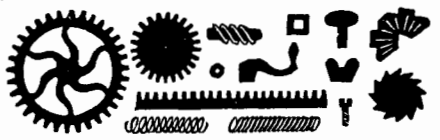

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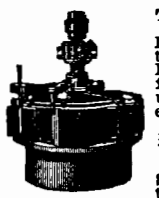

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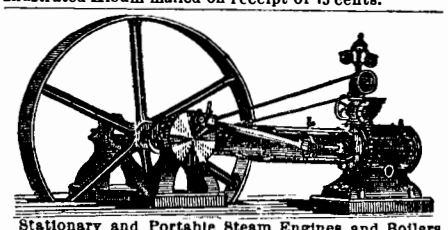

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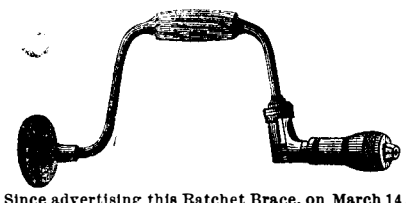

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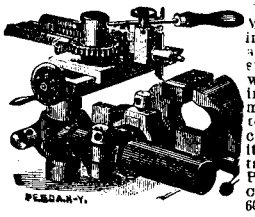

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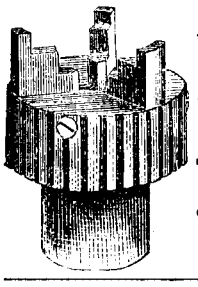

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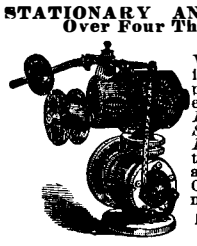

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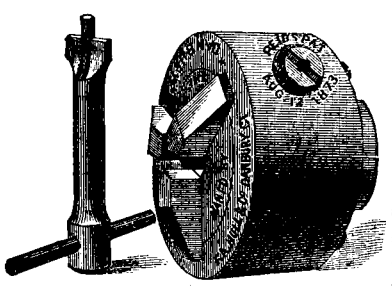

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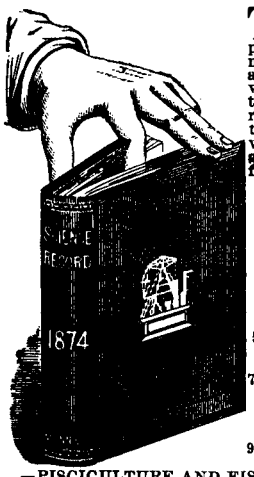

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